AMERICAN MACHINIST

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Norton's Emery Wheel Grinders.

The engravings on this page, and on page 2, represent several of these machines. It will be seen that they are very compact and solid machines, the base being cast in one piece, and the double-wheel machines having the wheels an unusual distance apart. The boxes are self-oiling, and the journals, as will be seen by reference to the dimensions given further on, are long.

The wheels furnished with these machines will run either dry or in water.

The 2-inch machine is intended for heavy work, and will carry wheels 24 inches in diameter. The diameter of spindle in bearings is $2\frac{1}{16}$", and between bearings 2'; length of journals 12". In this machine the wheels are 40" apart. The diameter of flanges is 10", and the cone pulley is $5\frac{1}{4}$" and 7"×$5\frac{1}{4}$". The entire length of spindle is 55", and the height of center of spindle from the floor is $29\frac{1}{2}$". Weight of machine 1025 lbs.

The $1\frac{1}{2}$-inch machine weighs 750 lbs., and will carry wheels of 20" diameter. The journals are $1\frac{9}{16}$" diameter, and 9" long. The flanges are 8" diameter; cone pulley $4\frac{3}{8}$" and $6\frac{1}{4}$"×$4\frac{1}{4}$". Entire length of spindle 44"; height of center from floor 33"; distance between wheels 32."

The weight of the 1-inch machine is 370 lbs., the wheels being 22" apart and 14" diameter. The length of spindle is 29", journals $1\frac{1}{16}$" diameter by $6\frac{1}{2}$" long. The size of cone pulley is $5\frac{1}{2}$" and $3\frac{1}{4}$"×$2\frac{1}{2}$", height from floor $37\frac{1}{2}$".

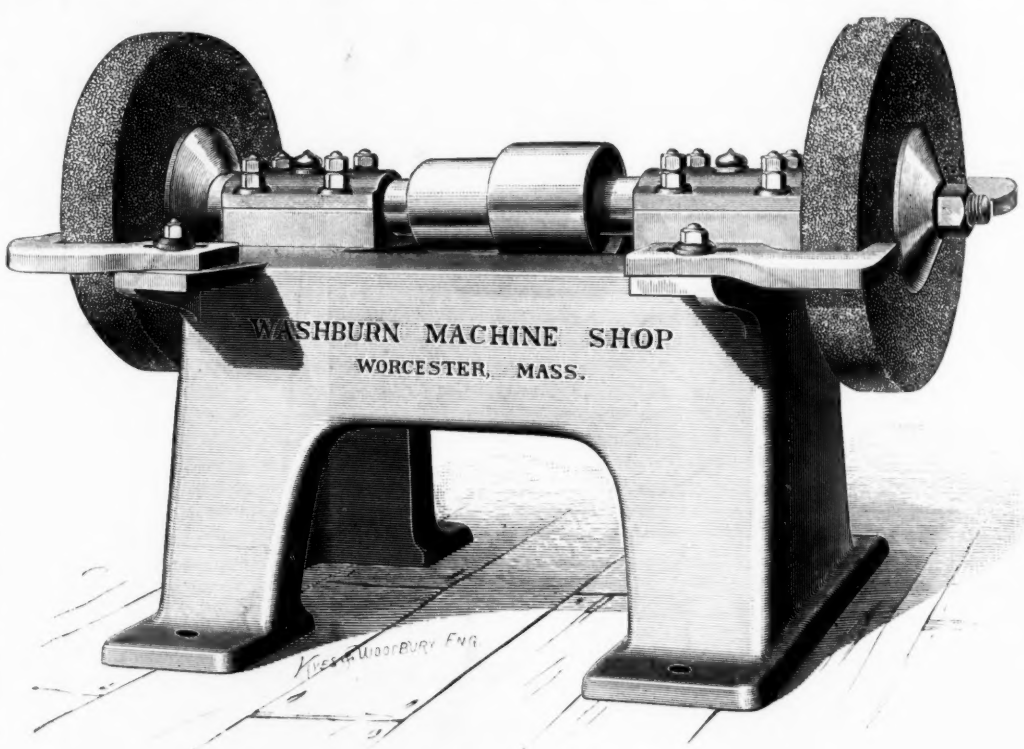
The 1-inch bench machine is very convenient for locating on the work bench, or on a special bench. The proportions do not vary materially from those of the 1" machine just referred to, except that the height is $7\frac{3}{4}$".

The $\frac{1}{2}$-inch bench machine carries a wheel 10" diameter, the distance between wheels being 12". The diameter of journals is $\frac{9}{16}$", length $3\frac{3}{4}$". The cone pulley is $1\frac{5}{8}$" and $2\frac{1}{2}$"×$1\frac{5}{8}$". This is a very convenient machine for light work.

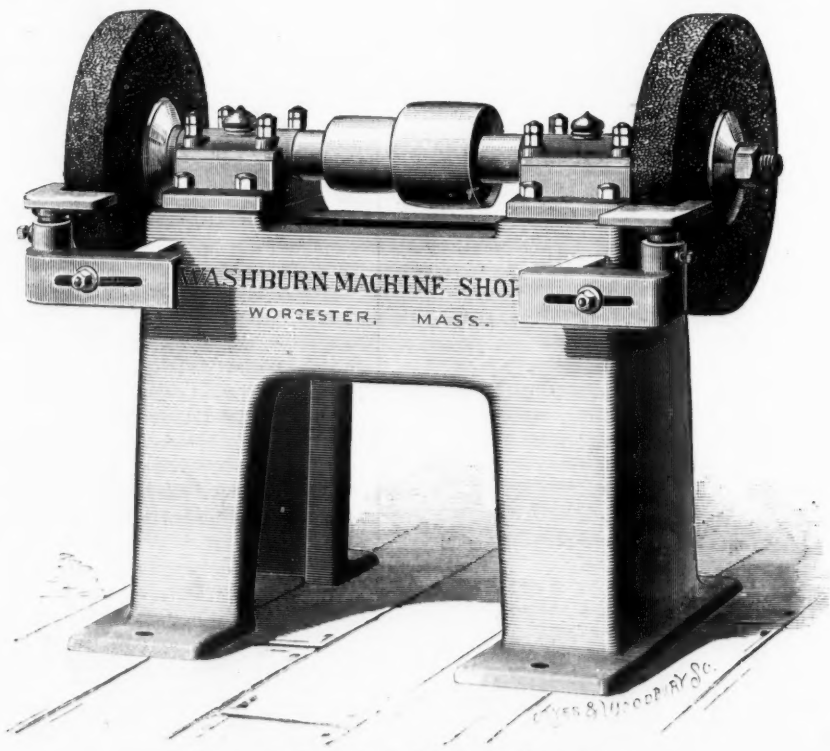
The single wheel machine is proportioned about like the others, and the cylinder machine is handy for some kinds of grinding.

Altogether the engravings we give represent a very complete line of this class of machines, well designed and constructed for their purpose. A feature of some interest is that they are made for the designer, F. B. Norton, of Worcester, Mass., at the Washburn Machine Shop, by students of the Worcester Industrial Institute. The substantial character of the work done on them speaks well for the management of the mechanical department of the Institute. Work of this kind, which mus tbe done in competition with other builders of similar machinery, serves an educational purpose much better than aimless tinkering.

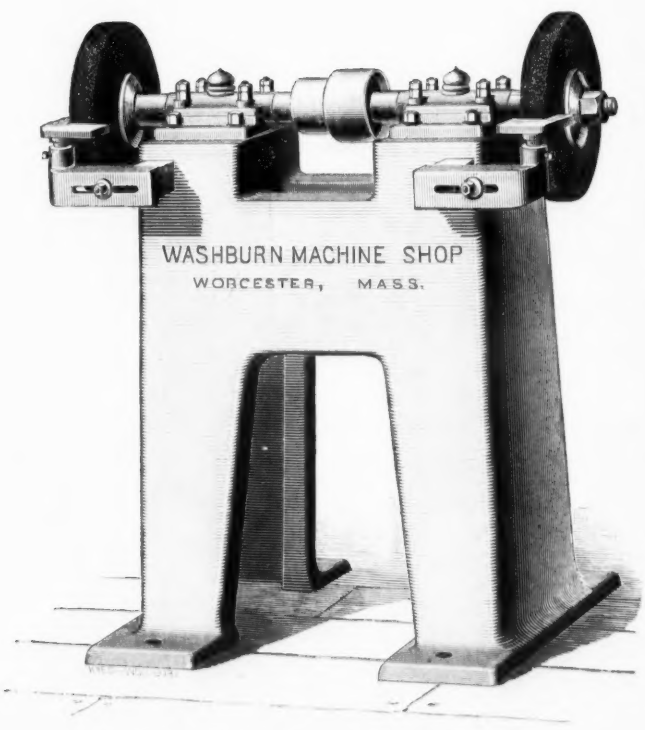
L. Best, Jr., 36 John street, is manager of the New York branch office for the sale of these machines.



TWO-INCH STANDARD MACHINE.



ONE-AND-A-HALF INCH STANDARD MACHINE.



ONE-INCH STANDARD MACHINE.

Brooklyn Navy Yard.

There is more than usual activity in the Brooklyn Navy Yard at present. They are working a fair force of men in the machine shops, mostly on repair work. The machine shop is large and commodious and is equipped with good modern tools, but the place is not utilized to one-twentieth of its capacity. When America gets a modern navy, in the construction and repair of whose ships the machinist, the blacksmith and the boiler-maker supplant the carpenter and sailmaker, there will be much more work carried on in the navy-yard shops.

The famous Tallapoosa is in the dry dock, and the hole which was torn in her starboard bow is nearly closed up by new planking. The upper works of the vessel were considerably damaged in pulling her up from the bottom but, they will be repaired soon. A force of men is engaged cutting up one of the wooden ships that has stood on the stocks so long unfinished, and the end of economy would be served if all the other wooden ships on the stocks were treated in a similar manner.

When Congress directs the reorganization of the navy-yards there is a likelihood that the Brooklyn establishment will rise in importance. The Commission appointed in 1882, to investigate the condition and value of the various navy yards, said a good many favorable words about this yard in their official report. The water approaches to the harbor were highly commended and they were said to be capable of being so defended as to make the yard practically impregnable. Another important advantage cited for the yard was that it is surrounded by a community

able to supply skilled labor in all the branches of iron shipbuilding and marine engineering and provide promptly all necessary material. Any sudden demand on the part of the Government for shipyard artificers or for seamen could readily be met, and the numerous machine shops, dry docks, and floating docks to be found in New York and Brooklyn, of which the navy yard could avail itself in time of need, renders this site one of the most advantageous of all in possession of the Government. What will strike the ordinary citizen as a curious disadvantage is the fact that iron-clads could lie close up to Coney Island and destroy with their shot the works in the navy yard. As there are no defences about New York harbor that could interfere with a proceeding of this kind, it may be interesting for people in the cities of New York and Brooklyn to reflect on what would be the condition of the property in the neighborhood in case an enemy wanted to destroy the navy yard.

Employers and Employes.

The following extracts are from a lecture by J. N. Mulford, of Troy, N. Y. Mr. Mulford is an Episcopal clergyman, known for his broad, liberal views on practical every-day affairs. Although the lecture had special reference to the Moulders' Union and the stove interests of Troy, the extracts we make are quite as applicable to other manufacturing interests and to other localities:

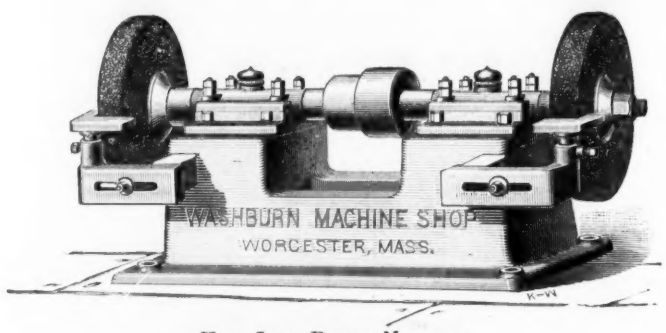
* * * * * * *

It is my duty at the outset to re-emphasize what we have heard a hundred times, viz.: that there is no reason for antagonism between capital and labor; there is no reason why manufacturers and workmen should be hostile to each other. Their interests are identical. If I have five cents and you have one cent, I am a capitalist and you are not, and if I put my five cents to such use as that you can earn something by it, and I also, then my capital is a benefit to both of us. Every man in Troy reaps the advantage of capital being employed here. What would become of our prosperity if there were no capital here invested in business? Could you have any stove business without capital? "Yes," say you, "we'd all put our savings together and form co-operative foundries." Well, it is possible for such foundries to succeed. I wish in my heart, for the sake of the workingmen, they could all succeed, so that every other industrious workman could participate in the proprietorship. But what is the drift of the majority of such foundries? Jealousy creeps in among the stockholders. The partnership results in a ring crowding out stockholders wherever they can, gobbling up stock, and a few getting the business into their own hands. If I am wrong in this, I trust I may be corrected. For, to me, one of the brightest outlooks for workingmen has always been in co-operation.

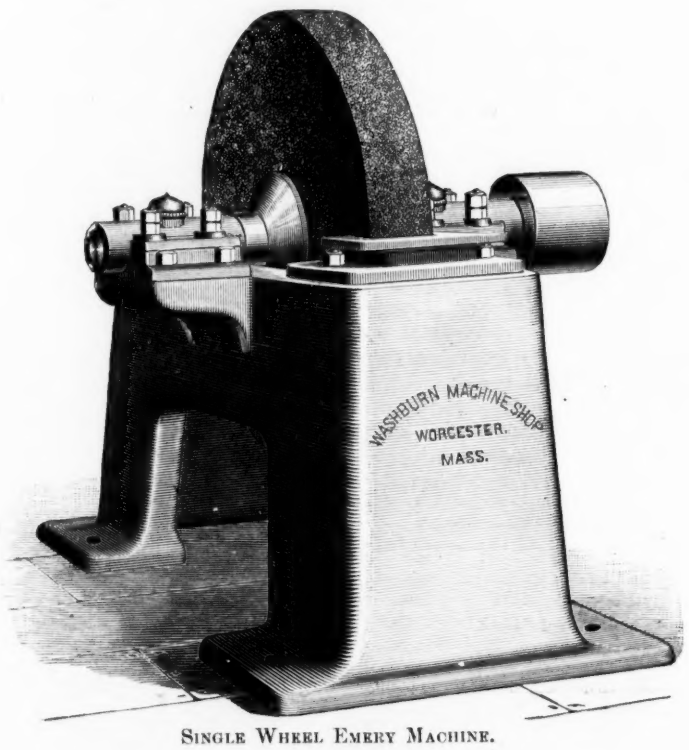
Capital commands business. The more capital employed in Troy, so long as there is healthy competition, the better it is for workmen. Even if I, as a moulder, have steady work in one foundry, it is better for me that there should be twenty foundries here than only one. If there were only one, the employer would have me in his power. If he were a hard, unfeeling man, he could oppress me; and I must submit, or go to the trouble and expense of pulling up stakes and moving away with my family to seek employment elsewhere.

* * * * * * *

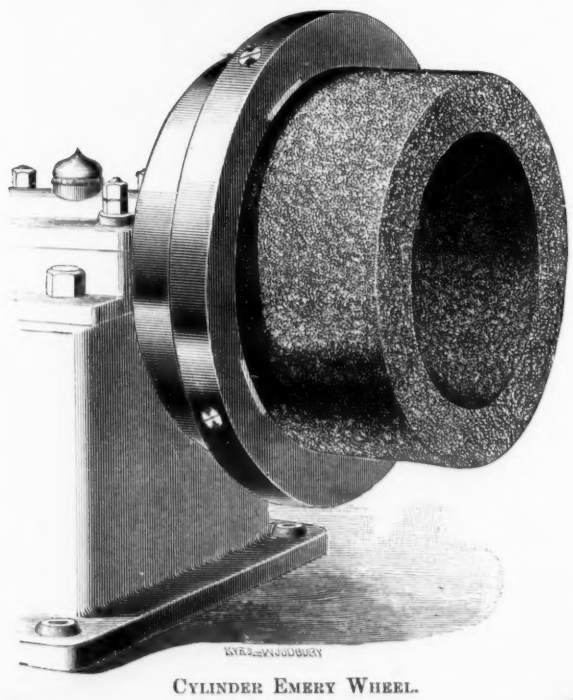
I have the deepest, strongest sympathy with workingmen; the problems of their peculiar trouble are often on my mind. In fact, I class myself as a workingman. Clergymen are not capitalists; as a rule they are poor, and cannot make money by their calling, while, when they get along in age, congregations do not want them, and, unfitted for ordinary business, they die poor. I have sympathy with workingmen. I think their only protection in some branches of business is in combination. I believe the pressure of combination, strong but gentle, does no harm. For the raising and lowering of wages does not come about freely like the gentle, noiseless rising and falling of the tide. Manufacturers find that when men's wages are fixed too high it is no easy thing to lower them to what the business can stand, and when workmen's wages are lower than their labor is worth, the men find it is no easy matter to get them raised. Of course, in the long run the true average level is found, but it is reached through struggle and sometimes by strikes, often costing workmen and employer more than the terms they fight for. In some branches of business, as among our collar manufacturers and their cutters and other employes, this matter finds adjustment without organization, either of proprietors or workmen.



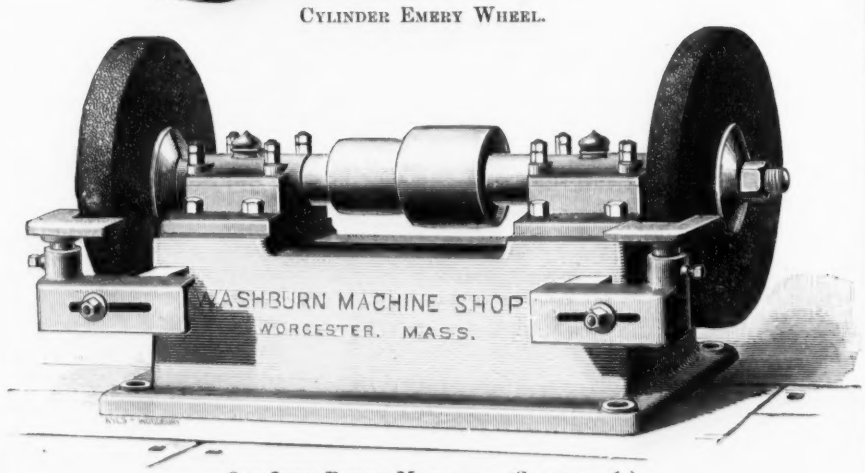
HALF-INCH BENCH MACHINE.



SINGLE WHEEL EMERY MACHINE.



CYLINDER EMERY WHEEL.



ONE-INCH BENCH MACHINE. (See page 1.)

As an observer of the methods of our Troy manufacturers and workmen, I want to tell you how some of their methods appear to me.

First, a word or two in regard to unions. And if I find fault with some things in them, it is no more than I would do with churches. It is no injustice to the churches in Troy to say there are bad men in them, or that churches sometimes do wrong and foolish things. And it is no injustice to the Moulders' Union or any other unions to say that there are bad men in them, and that they sometimes do wrong and foolish things. It seems to me that sometimes thoughtless, noisy, refractory men—men who have least to lose—have a controlling power in the unions. Sometimes they make rules and seek legislation contrary to the laws of trade, which is equivalent to making rules that water shall run up hill. The State Trades Assembly of this State is now using its influence to amend and repeal laws in the interest of workingmen. It is doing a good thing in keeping its eye on laws and usages inimical to interests of workingmen. As, for instance, the law to limit the age and employment of hours of labor of children, minors, and women in all factories, and the appointment of inspectors for the enforcement of the same. In planning a law to change the basis of prison labor so that it be not let by contract, but provided by the State, sold at market value, and the profits, after the maintenance of the prisoners and expenses of manufacturing, applied to the support of the families of the prisoners, or to the prisoners on their discharge from prison. But as I look at it, they have in contemplation some laws as inoperative as a law to make a copper dollar of equal value with a dollar of gold.

Strikes are always to be deprecated. Sometimes they are necessary. Both manufacturers and workmen in Troy are learning of late years more and more to avoid strikes by wise arbitration. There are times when strikes are inevitable, but no combination of workmen in this land of freedom can ever by force prevent a man from working or prevent an employer engaging workmen, without becoming a despotism and doing that which will inevitably react against the cause of those who do it.

Men who are on a strike may use all the force of reasoning and persuasion with their fellow workmen, but when their ardor passes into threats of personal violence, or when by their political influence they intimidate the judicial and executive powers of the city, then they are simply doing harm to their own most sacred interests. Any pressure exerted by a strike, beyond reason or persuasion, is unmitigated evil to the cause in which it is employed. These, I am glad to know, are the views of the great body of moulders in this city to-day.

* * * * * * *

I can see no reason why a skillful workman should not be paid higher wages than a poor one. Suppose a union of painters should include portrait painters, sign painters, and house painters, and forbid any person paying a Raphael, who could paint a Madonna, more wages by the square foot of canvas than an ordinary house painter for painting doors and base boards by the square foot. And yet the principle is the same by which unions grade down skilled workmen to the level of common workmen. If a man can do better work he ought to be paid better prices. According to the rules of some unions, they are against good workers and in favor of poor workers.

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Again, I have thought the settled, sober element in moulders' unions allow young, rollicking, unmarried fellows, who have so little at stake in a strike, to fan the flame and precipitate the whole body of men into a hostile attitude. What have these fellows to lose in a strike? They can pick up their kit of tools and go off to Philadelphia or Cincinnati, and leave the settled, married workmen to suffer and bear the brunt of the strike, while they travel around the country and have a good time. These are some of my criticisms on the methods of unions.

Let me offer some criticisms on methods

of manufacturers. I have said I have sympathy with workmen. I may also say that I often have sympathy with the men conducting a complicated business such as stove manufacturing. It is sometimes an ordeal anyone may wish to be out of, to regulate wages and satisfy the men, to meet the fierce competition of the trade, to be compelled to be inventing and improving in his line of goods in order to keep his position in the market, to meet losses all over the country from sales on credit, all this and more, to fret and worry makes it no easy berth. A man who puts $100,000 into such a business, when he might just as well invest it at six per cent. and have a nice income of $6,000 without a care or vexation, is entitled to some consideration. Of course, he isn't in the business because he is enraptured with the work of making stoves, nor is he in it out of pure philanthropy for workmen, nor is he always in the business in order to make money; but often because business life has become second nature to him, and to go out of business after middle life would be to stagnate and die.

No employer can afford to make purely arbitrary rules for his men. For instance, to require of his men a week's notice before leaving the shop, withholding wages as security for this, and yet not giving men a like notice before dismissing them; this would be purely arbitrary. Some rules may seem arbitrary when they are not so, but a rule not working both ways would be transparent arbitrariness.

A manufacturer is pursuing a foolish course who tries to get good work on poor wages. A man may as well hope to flourish physically on poor food as to get good work for poor pay. Dr. Tanner has of late been preaching about the benefit of living on bran, but when asked recently how it worked in his own case, he said he hadn't begun to try it yet. It is poor policy to try to get things cheap—for less than they are worth. Nay, it is a sin, that is the cause of much suffering, and an employer who knows that he can fairly afford to pay his men better wages and does not do it, who knows that the work is fairly worth more, is committing as actual a sin as stealing.

Workmen sometimes seem to act unreasonably in their conduct, especially when their demands for better prices are not complied with, and where unions overpower and control the more temperate workmen and carry them along with the noisy current. I have known some employers to storm against the injustice and unreasonableness of their men and regard it as a personal matter against them, when the men think they are only doing what the manufacturers are tempted to do—that is, to get work done as cheap as possible. I believe that the man who is considerate in his dealing with his men will have the minimum amount of trouble. Workmen appreciate a considerate, kind-hearted employer. They do not require that he have suavity and smiles, and should be among them a jolly fellow. They do not think any the more of him for talking sweetly and softly. They do not want to be cajoled, but they want to be treated like men and not machines. They want to know that their employer is their friend. And when a proprietor establishes himself in the confidence of his men, and proves himself such by various ways, such as carrying them along when trade is dull, giving them all the work possible, cutting down prices as little as possible; then, when the rush comes, and orders pour in and the foundry is taxed to its utmost capacity, and the men have their chance, they will return the compliment on their employer. I believe that a proprietor who takes pains to employ only the more sober, responsible, intelligent workmen, and treats them with kindness, will find, as a rule, a generous response to his kindness. But employers who always keep aloof from their men, who act like autocrats, who give no evidence that they care for their men, who try to regulate matters by posting up arbitrary rules around their establishments, who would sit in their office and not ask a committee of workmen coming for conference to be seated during the interview; who, when times are dull, put themselves to no inconvenience to tide their men over by contriving partial work, who deal with workmen as if they were little better than slaves—such employers occupy a position where they see all the bad points of workmen and none of their good points. I do not know that in these remarks I am photographing any Troy proprietor. Men dealt with in such spirit take no more interest in their work than is necessary to get their pay, and we should all do the same under the same circumstances.

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Again, I have lost no faith in the future of co-operation—co-operation in every department of life, and not only in conducting business. There are in the future better things in store for society, in which workmen will be the large gainers by co-operation. I have hope that the time will come, as it has already in not a few instances in England, when manufacturing establishments will be so organized as that the workmen according to their means will share with the proprietors in the profits of proprietorship.

Dr. Geo. H. Benjamin, of New York, has been engaged as electrical expert to devise a method of lighting the interior portions of a special machine, a large number of which are in use by the firm who have given the order. The method proposed is arranging an incandescent electric light inside each machine.

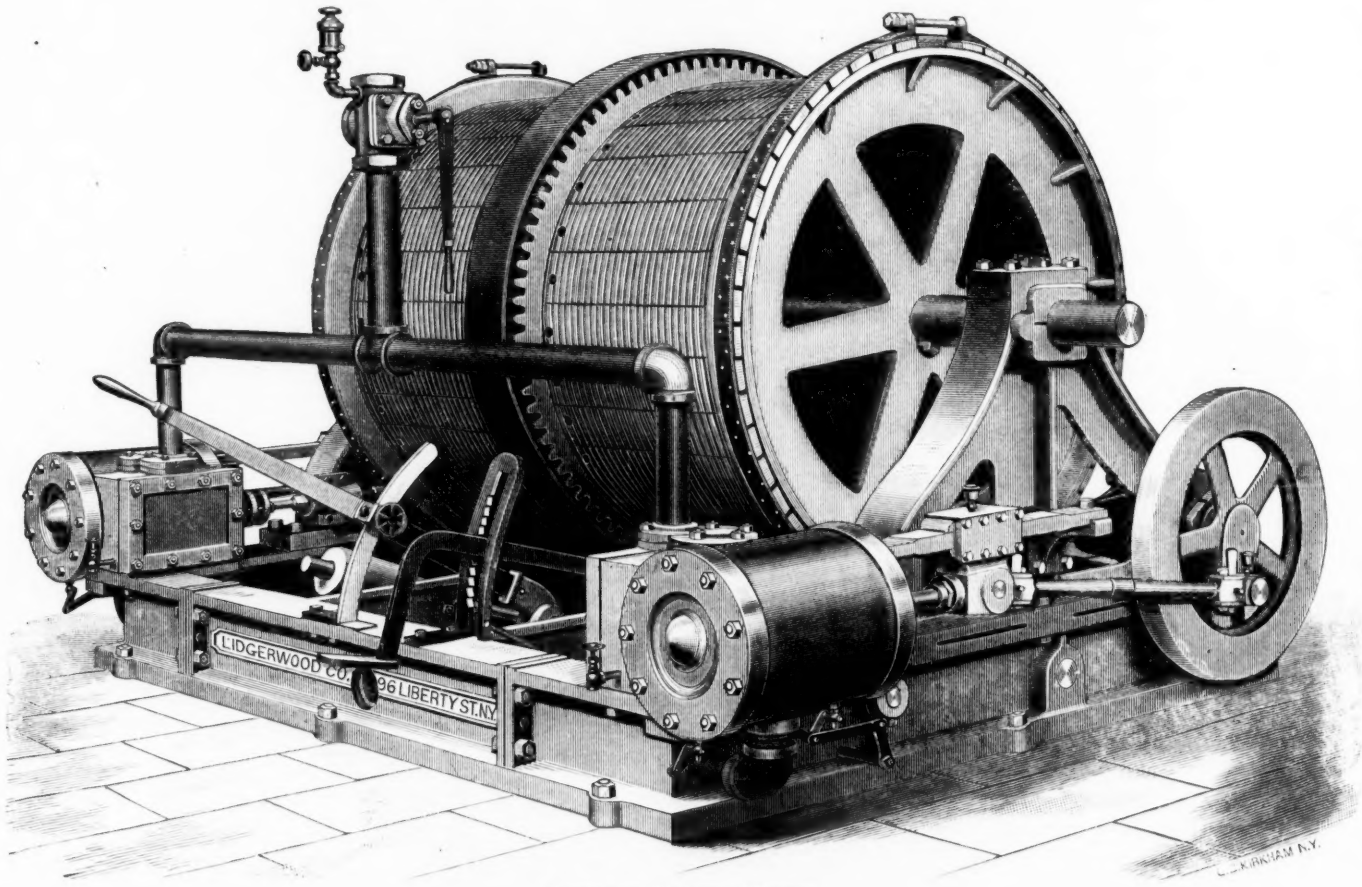
Mr. J. H. Morrison, assistant to Mr. Charles W. Copeland, is engaged writing a voluminous book on the development of marine engines. Mr. Morrison has access to many valuable sources of original information, and the likelihood is that his book will be an important contribution to the history of the marine engine.

Improved Hoisting Engine.

The hoisting engine which we illustrate herewith is one manufactured by the Lidgerwood Manufacturing Company, 96 Liberty Street, New York City. It is what is known as their double cylinder, double drum, reversible link motion and foot brake machine. It has fixed drums, and is particularly adapted for use in double shaft, slope, or incline hoisting in mines where one hoist is made while the other is lowered, and for two-track levels either above or below ground.

The parts of the machine are arranged upon a heavy base-plate, made in sections, faced and bolted together for convenience of transportation.

The parts which comprise the machine are simple and substantial, and, being faced and steady-pinned to the bed-plate, the whole is easily and quickly erected.



IMPROVED HOISTING ENGINE.

The connecting rods are fitted with gib and key ends. Composition boxes are used in connecting rods, and composition gibs on crossheads; main bearings are filled with anti-friction metal.

Piston rods, valve rods and pins are of steel, and main shafts of hammered steel.

The weight of links and connections are counterbalanced, for ease of handling.

The drums are made up of hard wood on cast iron flanges, the wood being strongly bolted to flanges and the latter securely keyed to shaft. In finishing, the drums are turned true, and spirally grooved for wire rope. Each end of drum is fitted with wood-lined strap brakes, which lead to a single shaft underneath. This is operated by a powerful foot lever, and can be set at any desired tension and left on. These brakes are easily adjusted for wear.

The steam cylinders, for different sizes of these machines, are 8¼, 10, 12, and 14 inches diameter, with stroke of 10, 12, 15, and 18 inches, respectively. The pistons are fitted with self-adjusting packing; valves are plain D slides, proportioned to cut off at three-quarters stroke when the link is at full throw. The crank wheels are counterbalanced.

These machines are provided complete with lubricator, oil cups, and accessories, ready for use. The arrangement of handles and levers has been schemed for convenience and ease of handling. Every machine is set up and tested under steam at the works.

Scraps, No. 1.

While this earth occupies its present position as regards the sun, and rotates around its present axis, mankind inhabiting the zone bordering on New York will require, besides food, in common with all people, clothing and shelter, and, until the fashion changes, coffins or burial cases. These are things we cannot do without. That they be well made is better than that they be poorly made; that they be made cheaply is better than that they be made at a waste of money, or a waste of human energy. To have these things we must have farmers, and carders, spinners and weavers, tailors, and shoemakers, stone cutters and masons, carpenters and joiners, plasterers and tinners, glass makers and painters, with hundreds of other workers in textile fabrics, metals, and wood; and the world will be just so much better off to have all these good of their kind, as the good of anything is better than the bad.

Though we might quarrel more or less if there were no lawyers, the lawyer is not a necessity.

Though we might know less, and "less that is not so," if we had no school teachers, the school teacher is not a necessity; and though we might get sick sooner or die later if there were no doctors, the doctor is not a necessity.

If the State has any right (which it has not) to give a fair portion of its public money for the education of lawyers, teachers, and doctors, it has the right to pay its money for the education of its carpenters, masons, and shoemakers. It has the same right to spend its money to make the poor man's son a good tinner, as it has to make the rich man's son a good instructor.

I understand all about the free school and that sort of thing; but the instruction has no bearing on the question of how is the boy or girl, the young man or young woman, to earn a living? It is of far more importance to the mason that he know how to handle a hammer, and to the carpenter to know how to handle a saw, than it is that either know how to read; and it is of far more importance to the joiner that he know how to file a saw than that he know how to write a letter; and yet in our community you may find a dozen journeymen joiners who cannot file a saw even decently well, to every one you can find who does not know how to write. It may be true that these things can be learned out of school; so can all things be learned out of school; but training the hand can be aided by instruction as well as training the mind, and in many things to even a greater extent; but it is to be presumed that no move will be made in this direction until the impression becomes general that there is some merit in knowing how to do a thing well, and some advantage to be gained by teaching the children of the poor the art of earning their own living.

Yours truly, J. G. TRAMIS.

The quantity of tin ore in the Black Hills is said to be very large. The industry of mining and smelting tin is likely to become an important one in this country.

LETTERS FROM PRACTICAL MEN.

Slide Valve Anomaly.

Editor American Machinist:

I have devoted great attention to valve motion, and thought I was familiar with every detail connected therewith, yet I was proved to be wrong in a very simple matter lately. I was asked the question, Which valve—one with, say, $\frac{5}{8}$, and the other with $\frac{7}{8}$ inch outside lap—will give the best port opening when hooked up, the throw of eccentric being the same? I readily answered the valve with $\frac{5}{8}$ inch lap, and found I was wrong, for the valve with the greater lap gives the better opening. When the matter is analyzed, the cause of the apparent anomaly is found to be that the centers of both eccentrics are nearer the crank where the increased lap is used, and the backing eccentric helps to increase the opening for the forward eccentric. It struck me as so odd that I considered the matter worthy of publication.

BUCKEYE.

Another Rehabilitated Invention.

Editor American Machinist:

As the account of the proceedings of the American Society of Mechanical Engineers, contained in your issue of Nov. 29th, describes what is claimed to be a new method of boiler construction in this country, it may be well, in the name of truth, to state that locomotive boilers were made, in the manner described, at the Mason Machine Works in 1875, and at frequent intervals since that time.

VERITAS.

Broken Water Line Glasses.

Editor American Machinist:

I was for a long time in the habit of washing water line glasses in a galvanized iron bucket, and they would break in a short time. About a year ago I began to use a wooden bucket, and have no broken ones since. Is this experience common?

J. U.

Tempering a Long Tap.

Editor American Machinist:

I notice your question No. 464, "Can you tell me a good way to temper a long tap or piece of steel to avoid springing?" If your questioner will, after finishing his forging, take an even heat on the whole length at about the same temperature he forged it, place it on end on the anvil and give it *one* square smart blow with a hammer, he will find no difficulty from springing, by following your suggestions. To prevent cracking, take out of bath immediately after it is cool enough to stop "simmering."

C. S.

Disconnecting a Locomotive for Broken Valve Yokes.

Editor American Machinist:

"S" asks the question, "Did I ever know a valve stem to blow out when it was only once broken?" I ask, what would prevent it blowing out after it was disconnected? Suppose he was carrying 125 lbs. pressure, valve stem $1\frac{1}{2}$" diam., there would be over 200 lbs. against the stem, and I would like to know what would keep the stem in, although he might not be able to pull it out by hand without removing the packing from the stuffing box? Of course a valve can be secured without removing the steam chest lid, but if, as is the case with nearly all modern built engines, the valve had been pushed as far ahead as it would go, the exhaust port would have been wide open, and the lid would then have to be removed to get the valve back.

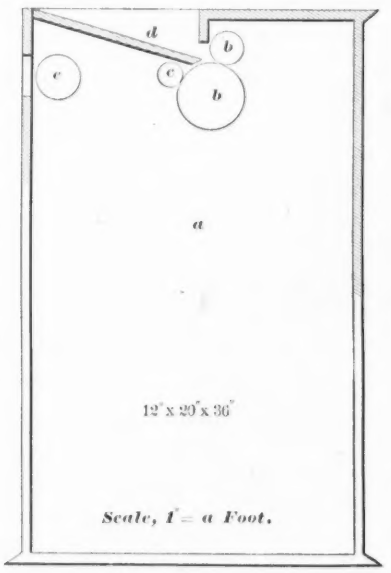
In reference to blocking cross-heads, I know of a recent case, where a valve got loose after the cross-head had been blocked, and caused considerable damage to cross-head, guides and guide-yoke, and caused more delay than if the "safe course" had been taken. The engine had $18\frac{1}{2}$" cylinders, consequently there was nothing but two wooden blocks to stand the shock of over 33,000 lbs. If "S" cannot see that the only safe course is to block the valve, I can only say, that, from all considerations, I am altogether sorry for him.

A.

The New Voting Machine.

Editor American Machinist:

We all know more or less about "party machinery," "machine politics," otherwise the old "demoralized political machine," etc. But here is a new machine, which may be said to belong to the category of politics, with which the people are not so familiar. Unlike the old concern above mentioned, it is quite tangible and satisfactory in its "make up" and operation. It has no "tools to grind," no "party affiliations to gratify." It is the work of a real inventor and machinist, hence it is an honest machine. It is made of good, sound material, and goes with a crank. It consists of a box, *a*, shown in vertical section, some three feet high, or of convenient height, when standing upon the floor, to hand in the ballots at the top. A pair of rollers, *b*, lie across the inside near the top, which are worked by a crank fixed to one end of the shaft of the lower roller. The rollers, working in close contact with each other, seize the ballot when it is placed in the hopper, *d*, and dump it into the box, where it cannot be disturbed till the time arrives for the officer who holds the key to unlock the box. The lower roller is provided with a cancelling device, which stamps each ballot as it passes between the rollers, ink being supplied by a porous roller, *c*, which holds ink enough, once charged, to cancel several hundred ballots. An automatic counter, *e*, is placed inside the box, where it cannot be tampered with, which indicates, on the periphery of three wheels, the number of ballots deposited—or, rather, the number of turns the crank makes—the intent being, of course, that a ballot shall enter at each turn of the crank. The ballot must be unfolded and placed squarely in the hopper blank side up, which precaution requires the close attention of the warden or clerk. If any demoralized voter should succeed in evading the vigilance of the warden, and deposit more than one vote at once, the machine will count and cancel but one of them. This feature is one of the chief advantages of the machine. While watching the operation of this machine the other day, it was suggested that it would be a decided improvement if about one-third of the voting fraternity could be worked with a crank. Upon reflection, however, it was decided that there was too much "crank" motion about this voting business already; that it was the "crank" that demoralized all the old political apparatus. If all the rascalities connected with this election work could be corrected by machinery, we should soon have better times. If the inventor will extend his researches to the domain of "political morals," and set at work some device which shall forever disfranchise that lawless gang that is ever seeking to compass their ends through illegal and dishonorable methods, he will confer one of the richest boons that ever blessed his race.



VOTING MACHINE.

F. G. WOODWARD.

Tool for Laying Out Thin Work on Both Sides.

Editor American Machinist:

I send you a sketch of a tool I have found very handy. I have never seen anything of

the kind, and thought it might be new to some. To make it, take a piece of hoop or sheet iron or steel, any length or width—mine is $1\frac{1}{2}$ inches wide and 3 feet long. Bend so there is a space of about $\frac{3}{16}$th inch, except 2 inches at each end. Rivet ends together, and dress edges straight. Then you put a sheet of metal between, and scribe along the edge on both sides of plate; the lines will be opposite each other, and by crossing the lines any point can be transferred from one side to the other, or work laid off on both sides of a sheet at once. One end can have a small bolt, to be taken out when you wish to reach any distance in on a plate. I have taken spring steel plates, 14 inches long by 5 inches wide, $\frac{1}{4}$ inch thick; drawn a line lengthwise, running from 2 inches from one edge to same distance on opposite edge, making the pieces wedge-shaped, and cut with a cold chisel on each side, then break them apart. It comes handy for sheet brass or any sheet metal. You can get a nice, clean break with much less cutting by doing it on both sides.

TINKER.

Pirating Patents.

Editor American Machinist:

Although ethics may not be one of the departments of your paper, there are some ethical points which may well be discussed by you, as they will be of interest to a great number of your readers, and not the least of these points is the constant efforts of some men to evade the spirit and adhere to the very letter of a patent claim. To "render unto Cæsar the things that are Cæsar's," is a duty that these men are always upon the alert to avoid. If they are engaged in any manufacturing, as they frequently are, every energy is apparently bent upon avoiding the payment of royalty on whatever device may be convenient or profitable to use in their regular or occasional work. Perfectly regardless of the time and labor that the inventor has expended in developing the device and adapting it to this pirate's needs, the latter will struggle and squirm and twist, and try to insert some little insignificant pin or stud, in order that he may not infringe upon the letter of the claim, while he is all the time infringing upon the broad and evident principles of the invention. It is almost impossible to so construct a patent claim that it will cover every possible combination that can be made while the general plan and the primary principles of the invention remain unchanged, and it is in the development of these obscure and foolish contrivances, these mere changes, so frequently absolutely detrimental to the mechanisms, the froth of a brain surcharged with conceit and wholly deprived of the fundamental principle of common honesty and decency, that these manufacturing pirates most indulge in. Such a condition of affairs may well be tolerated or even encouraged when the so-called improvements are worthy of the name, but such is rarely the case. They are called improvements but wherein does the improvement consist? They do the work no better, perhaps not as well as the original; they are not economical in the use of power and the first cost is no less; it is merely a specious covering for stolen property.

For instance a patent is taken out for the application of some piece of machinery to a certain purpose. The idea is new and the combination valuable. Perhaps the claim reads, "a —— to the performance of a certain work." Straightway the heart of the thief takes courage and rejoices for he thinks that perhaps he can apply s——to do this work; and this he will do in order that he may pay no royalty, even though he might better afford to pay what the inventor asks and use the original device. Then with an inconsistency that is born and bred of a petty and dishonest mind, this last improver tries, and sometimes succeeds, in securing a patent on his device—the worthless child of a worthless parent. This he guards and protects with the most jealous care, as though the very essence of his life were staked. And for what? Merely to cheat another of his dues.

The very existence of our patent laws, is a recognition of the rights of a man to the products of his brain, as the common law recognizes his rights to the products of his hands, and the Patent Office should be, and for the most part is exceedingly careful in granting patents to men who are little better than thieves. It is here, then, that the real inventor must look for protection, because no public sentiment can be aroused against this parasite. The work is quietly and stealthily done, out of sight, and so isolated that it can only meet with the condemnation that it deserves at the hands of the few who are cognizant of the particular case.

ALF.

Inventor of the Multitubular Boiler.

Editor American Machinist:

In one of his very interesting papers relating "Early Engineering Reminiscences," published in your issue of December 13th, Mr. George Escol Sellers, speaking of an interview with George Stephenson, says: "He explained very fully his train of reasoning and his experiments that led to the adoption of tubular boilers. He was no doubt the originator of the multi-tubular boiler, to which the great success of the present system of locomotive engines owes so much."

In these words, I believe Mr. Sellers is giving credit where credit is not due. George Stephenson was no doubt a great man, and the world is indebted to him for his rigorous persistency in advocating railways as means of intercommunication, but his great figure has often obscured the just claims of other inventors, and George Stephenson never troubled himself to put the world right in cases where, through mistake, he received credit for valuable improvements effected by other men.

Samuel Smiles, the well-known author of "Lives of the Engineers," makes George Stephenson one of his greatest heroes, and in numerous instances credits Stephenson as the originator of devices invented by other men, so he is not likely to do his hero any injustice in regard to the way the multitubular boiler came to be invented. On page 209, of the lives of George and Robert Stephenson, he says: "For many years previous to this period ingenious mechanics had been engaged in attempting to solve the problem of the best and most economical boiler for the production of high-pressure steam.

"As early as 1803, Mr. Woolf patented a tubular boiler, which was extensively employed at the Cornish mines, and was found greatly to facilitate the production of steam by the extension of the heating surface.

"The ingenious Trevethick, in his patent of 1815, seems also to have entertained the idea of employing a boiler constructed of small perpendicular tubes, with the same object of increasing the heating surface. These tubes were to be closed at the bottom and open into a common reservoir, from which they were to receive their water, and where the steam of all the tubes was to be united.

"About the same time George Stephenson was trying the effect of introducing small tubes in the boilers of his locomotives, with the object of increasing their evaporative power. Thus, in 1829, he sent to France two engines constructed at the Newcastle works for the Lyons & St. Etienne Railway, in the boilers of which tubes were placed containing water. The heating surface was thus found to be materially increased, but the expedient was not successful, for the tubes becoming furred with deposit, shortly burned out and were removed. It was then that M. Seguin, the engineer of the railway, pursuing the same idea, adopted his plan of employing horizontal tubes through which the heated air passed in steamlets.

"Mr. Henry Booth, the Secretary of the Liverpool and Manchester Railway, without

any knowledge of Seguin's proceedings, next devised his plan of a tubular boiler, which he brought under the notice of Mr. Stephenson, who at once adopted it, and settled the mode in which the fire-box and tubes were to be mutually arranged and connected. This plan was adopted in the celebrated Rocket engine, the building of which was immediately proceeded with at Newcastle works."

That is the usually accepted version of the story in Great Britain, and Booth is always credited with the invention of the multi-tubular boiler. If justice in the matter were done all around, it would, however, be found that to America belonged the credit of first producing the multi-tubular boiler.

As early as 1788, Nathan Read, a native of Warren, Mass., patented a multi-tubular boiler which possessed all the leading features of the present type.

Before Booth produced his plan that led to the Rocket being built with a tubular boiler, Peter Cooper had built a small locomotive for the Baltimore & Ohio Railroad which he built with a tubular boiler, using gun-barrels for tubes. America did more to develop the locomotive and railroad practice than the country has ever been credited with. It is doubtful if our railroad system would have been much delayed had George Stephenson never been born.

It is natural for Englishmen to claim the entire credit of originating the railroad system and the machinery for its operation, but I think Americans ought to know something of what their countrymen have done in helping the work forward. SAM. RARUS.

Pulverizing Glass—Making Sketches.

Editor American Machinist:

Seeing in the issue of December 6 a communication by J. F. Hobart, in which he asks for the successes and failures to be described, I will give my experience.

While running as engineer on a boat, I had occasion to grind the throttle, as well as some other valves; and knowing that emery was bad to remove from any rubbing surface after being well rubbed in with oil, as in grinding, I set out to pulverize some glass, which I succeeded in doing by using a tin box nearly filled with water. The glass was broken in small pieces, forming a layer $\frac{3}{4}''$ thick at the bottom. I used a punch, so as not to spatter the water. I have since found a better way to be to use a brass or iron cup, like a locomotive pump valve; then use a punch of about $\frac{3}{4}''$ round iron, having the end filed off square, and a leather fitted so as to cover the cup, and through which the punch passes after the manner of the drill used by men who blast rocks. I have been able, in one-half to three-fourths of an hour steady pounding, to reduce sufficiently fine about two tablespoonfuls. The leather, if closely held to the edge of the cup, acts as a dust guard. Glass from broken windows seems to cut better than that from lamp chimneys.

The sifting, which is quite essential, remains yet to be done. The plan followed for this was suggested by seeing a load of potatoes in a cart, with the large ones all on top. I get a sheet of thick writing paper. After placing a little of the pounded glass on it, in bulk not to exceed one-half teaspoonful, I hold the paper in one hand, slightly inclined, when, by tapping on its under side with the fingers of the other hand, the larger pieces will jump out and bounce along and off the edge. I always catch them and pound them over. This process may be carried on until the glass is sufficiently fine for most purposes. I have been thus explicit that no one may fail by reason of the omission of any detail.

I am sorry to say that it has not been my fortune to find such a proportion of men, as Mr. Hobart indicates, who can, even with a piece of chalk on the floor, make an intelligible drawing. A great many will take a piece of chalk, and after enough getting ready to make an elaborate drawing, make a single crooked line and then begin and talk about it. CHAS. S. BEACH.

Gloversville, N. Y.

Tendency of Curved Tubes to Straighten

Editor American Machinist:

Your correspondent, "Six H.," in the issue of December 13, referring to the subject of curved tubes tending to straighten themselves, suggests the practical test of a garden hose *bent*, and then admitting the water pressure. Here we have a *distorted* form to begin with, so that even without water pressure within it, it would tend to straighten itself if left free to assume its original straight line.

If the rubber hose were cast in any given curved form, so that all the fibres were without strain in that form, it would retain that form under an internal fluid pressure, except as it might change that form due to the enlarged circle rubber would permit it to make, and that enlarged circle compels a change of curve exactly analogous to the case of the flattened tube of the Bourdon gauge. Thus it would seem to be difficult to make a practical test to prove the theory maintained.

The theory that "a closed vessel of any shape, submitted to internal pressure, its sides will tend to assume such outline as will allow them to inclose the greatest cubical capacity," is true if the sides are of *equal thickness* throughout. I understand the theory to be that the sides will assume a form dependent upon the amount of material at one point to resist the pressure at *that point*, and if *exactly proportional*, then the cross section of a tube may be of *any* shape and it will not have even a tendency to change its form. Hence it is, because the tube in the Bourdon gauge is *not* circular, but of *equal thickness* of metal, that it tends to become circular, and that that change cannot take place without a change of its original curvature, and thereby tends to straighten itself. The elliptical form is preferred, "Six H." says, because it is found to be the most sensitive to pressure consistent with strength. So far as strength is desirable, it could not be found in a better form than the circular one. Is not its *sensitiveness* then due to its being elliptical?

A gauge manufacturer could set at rest the discussion by an experiment easily made and well made. A. F. NAGLE.

Inside Lap of Slide Valve.

Editor American Machinist:

In answer to my question (434) regarding inside lap, you say the effect [of a small amount] is not generally noticeable on the coal pile. Now, I have a $7''\times10''$ traction engine. The first season I ran it the exhaust deceived me several times, making me think the engine was blowing, but every time I tested it it was all right. The next season I faced the valve and seat, and took dimensions. I found the valve had $\frac{1}{32}''$ outside lap and $\frac{3}{32}''$ inside; travel, 2". I made a diagram, and it did not suit me; so I made another diagram without inside lap. This suited me better, and I cut out inside lap. The result is no perceptible difference in the running of the engine, but the use of between two and three bushels less coal per day, and correspondingly less water; also about 10 lbs. less gauge pressure to do the same work. I have no indicator to get the exact data, but the difference is enough so the fireman and the water hauler notice it.

I have done a good deal of overhauling, and my experience is that with the common slide valve, cutting off at $\frac{3}{4}$ to $\frac{2}{3}$ stroke, the engine works better with no inside lap on valve. FRANK HILL.

[In the particular instance noted by our correspondent, cutting out the $\frac{3}{32}''$ inside lap would cause the exhaust to open about $\frac{2}{10}''$ earlier, and close as much later in the stroke. We do not think this could account for the saving noted. He faced the valves and seats, and probably made some other repairs, to which we are inclined to credit the saving in fuel.]

EMPIRE SCROLL SAW.

Stevens' Locomotive Boiler.

Editor American Machinist:

The type of locomotive boiler illustrated in the last issue of your paper, and used by Mr. A. J. Stevens, of the Central Pacific Railroad, is not a new thing. I remember several locomotives upon which that style of boiler was used. I am not positive, but think the engines were built by the old Morris Works, Philadelphia. The style of boiler was almost exactly the same; large and small tubes, combustion chamber about midway of the barrel, dome placed well forward, etc. There was a slight difference in the fire-boxes. The old locomotives I have reference to were intended to burn wood and had somewhat shorter fire-boxes. They were of the ordinary eight-wheel type, with drivers six feet in diameter. The cylinders were, I think, 16"x22" inches. They were pretty free steamers, and could run like the wind after they got started. They were a little slow on the start.

ENGINEER.

"Hardening and Tempering Steel."

Editor American Machinist:

Many readers of your valuable publication must feel greatly interested in any communication from the author of the article under the above heading in your issue of Dec. 13. To the expert they are always both suggestive and instructive, and to the careful student invaluable, showing as they do an exceptional acquaintance both theoretical and practical, which is, no doubt, greatly appreciated. I hope we may continue to have communications on this important subject.

It has been said that if our failures (with the *modus operandi*) were recorded, we should often have as valuable information in teaching us what to avoid, as in many cases the wherefore and results of success; yet there are few of us care to fully explain our failures, often silently chiding ourselves on what we at the time consider our folly. But should we not remember that that very information might be the means of saving many, especially beginners, from the often very disheartening ordeal? To come to the point, will Mr. Goodyear kindly forward a specimen of the cracked pieces, and a worn-out specimen of the successfully hardened pieces? state what steel is used, and include sufficient for, say, two similar articles, and, if quite agreeable, describe the means used and precautions taken in trying to successfully harden the larger pieces prior to having recourse to the final comparatively expensive (I should say) method of manipulation?

The circumstance is peculiar, and deserves study and scrutiny, and if afforded the opportunity I, for one, should like to experiment with a view to elucidation, and will at any rate communicate the result. If the proposition is entertained, I should like to have the following particulars: What degree of hardness is requisite? Is it imperative that it be as homogeneous as possible throughout the piece, or is it for strength's sake necessary to modify or temper any portion of it? Also, is it imperative that the hole itself should be *glassy hard* (as for a jig)? and any other particulars, either necessary or permissive. W. DICKS.

The "Empire" Scroll Saw.

This saw is designed so as to be operated by either foot or steam power, as desired. It may be used on either light or heavy work, having the capacity to cut up to three-inches thick, and will swing 24-inches.

It is provided with driving wheel 24-inches diameter, a **V** shaped driving belt being used to secure the necessary power without slipping. The foot motion is of the double treadle kind, which is worked by a walking motion. It is claimed that by this means more power is obtained with much less fatigue to the operator. The regular arrangement is for using an 8-inch saw, but the adjustment can be quickly made for a 5-inch saw, for light work.

The arms are of wood, so pivoted as to avoid side motion; these with the self-adjusting saw clamps used, give an up and down motion very nearly in a straight line. The table is of iron, nickel plated, and can be adjusted to any angle desired. An adjustable upright drilling attachment is furnished, with chuck for holding from 0 up to $\frac{3}{16}''$ twist drills.

The height from floor to top of table is 40 inches. For steam power tight and loose pulleys are provided, arranged to connect to driving wheel shaft on either side, leaving the treadle connected on the other side.

This machine is made by the Seneca Falls Manufacturing Company, Seneca Falls, N. Y., and sold in New York City by James T. Pratt & Co., 53 Fulton street.

The Detroit Association of Stationary Engineers No. 1, of Michigan, wishes to found a library and reading room. It has issued an appeal for assistance to manufacturers, merchants and other business men. The reason given is that the public library does not contain one standard work on engineering published within the last ten years.

M. N. Forney on the Car Builders' Association.

Mr. M. N. Forney, secretary of the Master Car Builders' Association, has done a great deal to urge forward the association, and important reforms in its organization have been carried out principally through his exertions. But Mr. Forney is not yet satisfied, and he still calls for better methods of investigating matters connected with railroad cars. He has recently addressed a long communication to the *National Car Builder* on the adoption of standards, in which he dilates at considerable length on what the association has done towards advancing the adoption of standards, and he makes out that their labors in this line have brought about important results, although not so satisfactory as might be desired. The weak points of their methods of investigation are pointed out and remedies suggested. In this connection he says:

The kind of help that the association needs is that of a person competent to undertake investigations of the kind which are now referred to committees, and which require more time and labor than the committees can give to them. His duties should be such that any committee could call on him to co-operate with them, so that the main part of their work would be done by him, and they would then become an advisory body, to deliberate and decide on that which he would prepare for them. He ought to be a person who has had a great deal of experience and knowledge of car construction, a good designer of work, with the ability to investigate the subject thoroughly, and a judicial turn of mind that would not draw conclusions until the evidence was all in, be sure and conservative in his judgment and of systematic habits, so that the records and archives of the association would be properly preserved. These are yearly becoming of greater importance, and no steps have so far been taken for their preservation. Many or all of them might be lost by a fire or the death of the person who has the care of them. The association should have an office in a fire-proof building, where its books and papers would be stored, and this office, to some extent, should be a drawing office for all the railroads of the country; that is, it should be prepared at all times to furnish prints of the standard drawings which the association has adopted. It is of the utmost importance, too, that when the association does adopt a standard, that a careful and accurate record of it should be made. As much pains should be taken to secure and preserve its accuracy as is taken in making a title to a piece of real estate. Then, too, no time, trouble, or skill should be spared in perfecting standards. If the weight of the standard journal bearing, box, or pedestal could be reduced a single ounce and leave it as strong as before, it becomes of great importance when these parts are reproduced by hundreds of thousands. A single hammer blow saved in the construction of a truck would amount to $460.000 \times 2 = 920,000$, or nearly a million hammer blows if all the cars, or as many as are represented in the association, are equipped with new trucks.

Master Car Builders Circulars of Inquiry.

We have received copies of three circulars from this association requiring information on subjects under investigation. A committee consisting of Charles Blackwell, Norfolk & Western Railroad, Roanoke, Va.; George W. Demarest, Northern Central Rairoad, Baltimore, Md.; and M. N. Forney, 73 Broadway, New York, requires information respecting dead blocks, so that they can recommend the proper form for a standard. Mr. Blackwell is chairman of this committee, and all replies should be addressed to him. "Trap-doors in the Roofs of Passenger Cars" is a subject under investigation by F. D. Adams, Boston & Albany Railroad, Allston, Mass.; John MacKenzie, New York, Chicago & St. Louis Railroad, Cleveland, O., and Sanford Keeler, Flint & Pere Marquette Railroad, East Saginaw, Mich. The object of this committee is to find out whether it is desirable to put trap-doors in the roofs of passenger cars to aid the escape of passengers in case of accident, and to decide on what form and size of door would answer best if the arrangement is deemed necessary. Mr. Adams is chairman of this committee.

Joseph Townsend, Chicago & Alton Railroad, Bloomington, Ill.; John Hodge, Missouri Pacific Railroad, St. Louis, Mo., and C. E. Gore, Lafayette Car Works, Lafayette, Ind., are a Committee on "Side Dumping and Drop Bottom Coal Cars." They request the members of the association to send to the chairman of the committee, Joseph Townsend, copies of drawing of side dumping cars they may be using, with opinions of which kind of car is best.

Transporting Machinery Under Difficulties.

Last summer Mr. Frank Tulloss, a mechanical engineer of Iowa City, undertook to erect a plant of mining machinery at the Carmea Mine, Chihuahua, Mexico. The mine is in a remote mountainous region, and the material had to be transported a long distance in a most primitive fashion. In going round a mountain pass, a mule that was carrying a section of a boiler missed its footing owing to the boiler sheet striking a projecting ledge, and mule and boiler iron went over a precipice. They had some trouble recovering the section of the boiler, but it was not much damaged when they got it up. They could not do anything, however, with the fragments of the mule that were scattered around the rocks. At Alamos Mr. Tulloss visited the mint, and found an American in charge. The machinery in the place was very crude, but it turns out fair coin, the American machinist making the dies. A curiosity of the machine shop connected with the mint is that a man can stand at the lathe and reach out to oranges growing on a tree outside.

Dr. Arvine on Lubricants.

During the discussion on lubricants in the last meeting of the Mechanical Engineers' Society, Dr. Arvine, analyst for the Standard Oil Company, gave many interesting facts of his experience. To a practical man, who wants to know what he needs to put upon his engine, the value of the "coefficient of friction" is extremely important. We know perfectly well that it depends upon many conditions that are difficult to maintain and to understand. Even the wisest admit that there is very little yet found out which throws practical light upon this subject. For instance, we know perfectly well when they decide the coefficient of friction of paraffine oil on two polished surfaces made to fit perfectly, we gain no light at all on what we need to use on bearings that do not fit equally well, or have the same finish. If we are to decide how to construct a bearing, what its proportions would be, how large a segment it should cover, all of these researches would be directly to the point. But if we have an engine that runs hot, or a certain construction of railway bearings that makes it difficult to find a suitable lubricant, these investigations afford us no light whatever. Crediting all possible value to researches regarding the coefficient of friction, what we most want to know is vastly beyond that. For instance, an engineer comes and says, "I was using such a paraffine, and my engine ran cold. I am now using such a paraffine and my engine runs hot." We find on examination that there is no practical difference between the two, but when we come to apply them to a bearing we find that for some reason the oils do not work alike. When we apply them to spindles we find that two paraffine oils often bear no relation to each other in their practical behavior. We find that one will run at a much higher temperature, for some obscure reason. We might think it due to velocity, but we find by our instruments that it does not depend upon that. In some instances, too, the results we obtain are exceedingly contradictory. The Rochester & Pittsburgh Railroad Company run their cars with a bearing the surface of which is composed, apparently, of lead—it appears to be lead spread over the inner surface of the composition box, which looks as though it might be gun metal. They say they can run an oil on this soft bearing that I know positively fails under similar circumstances and on the same class of cars on the New York, Lake Erie & Western, the New York Central, and the Delaware & Lackawanna—just why, I cannot say. A shaft will sink down in that bearing, and yet it runs cold, and runs on a very cheap oil.

One of the oil companies manufactures an oil which is composed largely of a mineral base united with fatty acid. All things considered, that oil has been the most successful for running cold of any oil used on railroads. And yet that fails to equal some cheaper oils on the friction testing machines. We have lately made comparative tests on fast-running Sawyer spindles. We have half-a-dozen oils from Europe, and several made in this country. Adapting a dynamometer to this I expected to find that oils having the best body would be the best oils for these spindles, but I found that I did not know anything about it. After having read many papers and listened to a great deal of talk from gentlemen who know a good deal about it, I found that the spindles did not bear out anything I expected. A spindle that was nicely fitted behaved in one way, but a spindle that was badly fitted behaved very differently. The effect of this was to establish a friction of its own in addition to the friction we generally speak of as due to the oil itself. If we put on oil that has a good body the heat increases very rapidly. Now, we say at first that that was an objection to that oil. But we found, after running them for a short time, that the oils which gave us the best results in the economy of power were the ones that produced the most rapid wear. We found after running constantly at some 6,500 revolutions a minute, that it lost as much as one-tenth of one gramme in actual weight. When we took another paraffine oil the wear was not half that, and there seems to be no apparent reason for it. One reason why these Sawyer spindles ran so well was that they run in a flooded bearing. The question of wear on bearings, as ordinarily found, is more important than the cost of oil. One large mill owner came recently and said he wanted an oil for his spindles. He did not care what it cost so long as it was efficient, for after running eleven mills for many years he had discovered that so great loss was sustained from wear due to poor lubrication as to make the mere price of oil unimportant.

When the engines of the Brooklyn Bridge were started up, the faulty construction of the bearings of journals caused rapid heating. The main bearings were made in such a way that the bearings pinched the sides of the journals, and the binding increased with the rise in temperature, the expansion of the metal producing this effect.

We generally find that where we can use oils of higher viscosity ordinary machinery bearings run colder; but in some instances of high speed and heavy pressure only thin oils answer at all, and the bearings must be flooded. The engines that run the Edison dynamos in Pearl Street are rated at 75 horse-power, and run at the rate of 375 revolutions per minute. The oil they are using on these bearings is about 32 degrees Beaume gravity, which is almost as light and fluid as common kerosene, and it is the only kind found to run cool, but it requires to be supplied constantly.

I have come to think that this arranging of a steady current of thin oil is a very desirable plan, wherever it can be practically carried out, as in various spindles and nicely finished and fitted bearings of large dimensions, such as those in machines devised for testing oils. With bearings nicely finished, and journals carefully scraped and ground to fit, an abundant and constant supply of thin oil will give the best possible result in keeping the bearings cold and saving power. With such machines you may learn much of the proper proportions of bearings and of the conditions of friction in relation to pressure and speed; of oils, too, under the exact conditions of these machines, but nothing of the requirements of machinery in common use. Some experimenters think of a journal and bearing as two cylindrical surfaces in perfect contact. It would be more scientific and practical to regard the fit of ordinary bearings like that of a pea in a bushel basket. In many instances, one point of contact would be too much to expect, and the body or viscosity of the oil must make the fit. The results in testing heavy lubricating oils on testing machines do not correspond with the practical working of these oils on railway axles and other machinery; and any engineer to whom you might supply oils selected from such data would soon come back to you, as the saying is, "with tears in his fist and his eyes doubled up." We have been there—both sides.

The fact is the most important conditions under which the tests are made are the very ones that can only be maintained under special and unusual circumstances, and are never found in the great mass of machinery that must be lubricated. This makes the friction tests by special machines worthless as a means of selecting lubricants, and a delusion to those whose opinions of oils are thus founded.

I believe that the great value of these friction tests, and the machines by which they were made, lies in another direction; for we know that scientific research lies at the root of all industrial progress. But I think we must try an engine oil on an engine, a spindle oil on a spindle, and a wagon grease on a wagon, all as nearly as possible under the ordinary conditions, to learn anything of the real value of the lubricant.

While speaking of spindle oils I should have added that I found the bearing parts did not wear bright. I considered their frosted look as indicative of a friction I saw no way of estimating, although it was attended with rapid wear. With oils of higher viscosity and heavier gravity the bearing surfaces polish like a mirror, even though the friction, judging by the power consumed, is much greater with the more viscous oils. I infer that we cannot judge of the actual friction occasioned by the moving surfaces in contact, while we are unable to estimate separately that friction attributed to the oil itself. For using a thin oil, we decrease that one friction so greatly that we cannot note any lesser increase in the other which occasions wear. If it be true that the question of wear is frequently of paramount importance in choosing special oils, then a low coefficient of friction is no measure of value, and our frictional tests are worthless as a means of judging.

It is frequently said that we have petroleum oils which alone answer all requirements of lubrication. It is not so. Practical experience fully proves that in many instances compounded oils are best. Sometimes a thin petroleum oil, with a small portion of animal oil, gives better results. There are instances where the best petroleum oils do not answer on an engine, when lard oil, or a mixture principally lard oil, keeps the engine cold and in every way satisfactory. This is sometimes the case whether the petroleum be of heavier or lighter gravity than the lard oil. But these are rare instances where petroleum oils do not answer every requirement.

A small portable boiler exploded recently in England, the cause of the explosion being traced to leakage of water which was held in contact with the sheets by the lagging until they were in places corroded away to a thickness of one-sixteenth inch. The leakage occurred where the feed entered the boiler.

Between two and three thousand patents on reaping and mowing machines have been taken out in England.

In England compound farm engines have been introduced to some extent, and it is believed there that they will come into quite general use. Ordinary engines with variable expansion gear are held to be too complicated for the talent usually employed in connection with agricultural engines, while the economy desired can be secured with the compound engine, and the simplicity of the plain type of engine retained.

C. W. and H. Eberhardt of Newark, N. J., have patented a simple form of lathe friction brake that is designed to operate against the flange of a pulley, on which a belt runs, proper mechanism being provided to apply the brake promptly by the man operating the lathe.

Part of the inventive ability that has done so much to perfect agricultural appliances seems now to be turned in the direction of finding cheap methods of draining wet lands. Several ingenious ditching appliances and drain-tile laying machines have recently been patented.

The London *Ironmonger* thus reports the Birmingham trade in machinery and machine tools:

"This branch appears to have escaped hitherto the extreme depression complained of in so many other local industries, and machinists generally are able to keep their hands fairly employed, but business is unmistakably declining, and firms which were hard pushed and working overtime a couple of months ago are now beginning to cast about them for orders. In heavy engineering work, and especially railway bridges of iron and steel, there is a fair amount of business stirring, and the big constructive companies, like the Horseley Company and the Patent Shaft and Axletree Company, are generally well employed on home and Indian contracts, but in machinery proper there is a decided slackening of demand since the reaction in the northern shipbuilding trade set in, and the northern engineers and machinists began to turn their attention and direct their energies into new channels, hitherto monopolized by the midland machinists. There is very little Government work under execution here just now, beyond shaping machines for dockyard use."

A German engineer, named Fisher, has made an important discovery in aeronautics, by which he is enabled to condense or expand the gas in a balloon. The agent he employs is compressed carbonic acid, with the help of which he can ascend or descend at pleasure. This perpendicular movement puts it in the power of the aeronaut to go up or down until he finds a current of air moving in the horizontal direction he wishes. Military critics attribute great importance to this discovery, because in time of war a balloon will be able to reach the enemy's territory and ascend again without requiring a fresh supply of gas.—*Boston Herald.*

The London *Times* says: "In many foreign countries, especially in Germany, it is not easy to obtain patents; and it is freely said that German manufacturers have been permitted to inspect English and other foreign applications for patents which have been lodged with the officials, and that the processes referred to in them have been in full swing in German workshops by the time the applications have been refused." Perhaps the most audacious appropriation of an idea is that related in the autobiography of Nasmyth, the inventor of the steam hammer. He had at his works a "scheme book," in which he jotted down ideas for new tools and machines as they occurred. One day, during his absence, M. Schneider, of the famous Creuzot Works, accompanied by his mechanical manager, visited Patricroft, and, among other things, were shown the "scheme book." A certain page particularly excited their attention. It contained a sketch of the steam hammer, which at that time had no other existence. Notes and sketches were taken by the visitors, and they went on their way. Some time afterwards, and before Mr. Nasmyth had given practical shape to his steam hammer, he was visiting the Creuzot Works, and there, to his surprise, found a steam hammer on his plan actually in operation and achieving great things. The origin of the machine was admitted, but Mr. Nasmyth seems to have been too well pleased with the demonstrated success of his idea to make any complaint. He returned home soon after, patented his invention, and gave to his countrymen one of the most important machines ever introduced into the iron manufacture."

Inertia Diagram.

By JOHN W. NYSTROM.

SECOND PAPER.

The inertia diagram, Fig. 4, in the AMERICAN MACHINIST for Oct. 18th, page 3, by Mr. Ed. F. Williams, is an excellent illustration of inertia of reciprocating parts of a steam engine, and the object of this article is to furnish some formulas by which to find the inertia at the front end and back end of the stroke, and also to find the point on the center line where the diagram crosses.

F=force of inertia in pounds at the front or back end of the stroke.

W=weight in pounds of all the reciprocating parts.

R=radius of the crank in feet.

n=revolutions per minute.

L=length of the connecting rod in feet.

Back end inertia, $$F=\frac{WRn^2}{2933\ 54}\left(\frac{L+R}{L}\right) \quad 1$$

Front end inertia, $$F=\frac{WRn^2}{2933\ 54}\left(\frac{L-R}{L}\right) \quad 2$$

d=distance in fraction of a foot from the center of the stroke to where the inertia diagram crosses the center line.

$$d=\sqrt{L^2+R^2}-L. \quad . \quad . \quad . \quad . \quad 3$$

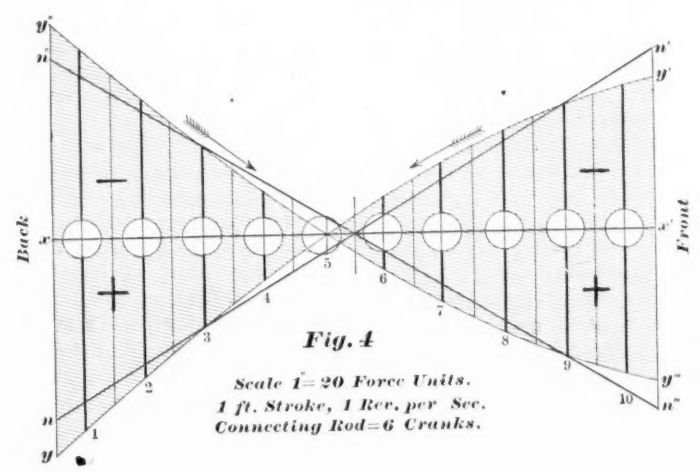


Fig. 4

Scale 1"=20 Force Units.
1 ft. Stroke, 1 Rev. per Sec.
Connecting Rod=6 Cranks.

This distance corresponds with that between 5 and 5½ on the diagram, Fig. 4. [Reproduced from our issue of Oct. 18th.]

Formula 1 gives the force of inertia $x\,y$ or $x\,y''$ at the back end of the stroke, and Formula 2 gives the force of inertia $x'\,y'$ or $x'\,y'''$ at the front end of the stroke.

Examples 1 and 2. The reciprocating parts of an engine, including the connecting rod, weighs w=1000 pounds. Radius of the crank, R=1 foot, n=200 revolutions per minute. Length of connecting rod, L=8 feet. Required the force of inertia at the front and back ends of the stroke?

Back end, F=

$$\frac{1000\times1\times200^2}{2933.54}\left(\frac{8+1}{8}\right)=15339.8 \text{ pounds.}$$

Front end, F=11931 pounds.

Example 3. Find the distance, d, from the center of the stroke to where the diagram of inertia crosses the center line, with the same dimensions of connecting rod and crank.

Formula 3. $d=\sqrt{8^2+1^2}-8=0.0622$ of a foot or $\frac{3}{4}$ of an inch.

Consuls as Merchants.

A bill is to be introduced into Congress during the present session to permit American Consuls to engage in mercantile pursuits, and to encourage the appointment of merchants to Consular positions. There are two sides to the question. A member of the New York Chamber of Commerce, who is a prominent merchant, recently said to a *Sun* reporter:

"It is a proposition to go back to a system which resisted the united efforts of American merchants for at least thirty years before it was overthrown. What is a Consul for, anyhow?" he asked.

Glancing at a pile of blue-covered Consular reports issued from the Government printing office, the reporter replied, "To write books."

"Those pamphlets contain some queer productions of genius," the merchant answered, "although now and then one proves of great value. But a Consul must have other knowledge than that of writing readable reports. He must be commercial agent, to seek and put in shape all sorts of information about the resources and requirements of the country in which he is stationed; a guardian of the estates held by Americans in the country where he resides; a warehouseman in charge of wrecked American property; an attorney for American citizens who are in legal or other trouble in a foreign land; and to a greater or less extent a diplomatic agent to secure from the local authorities, at least, such recognition of American rights and such concessions to American enterprise as may be possible. But the most valuable part of a Consul's stock in trade is a knowledge of the resources and requirements of the country to which he is sent. How would a merchant act in this position? Would he disseminate his capital broadcast as his Consular duty requires, or would he keep it to himself as his mercantile instinct directs? For an answer, compare the reports of certain of our so-called commercial agents, who are foreigners and merchants and represent us at minor ports, and the reports of those Consuls who are American citizens and not engaged in trade. Would he sacrifice his own trade in order to conciliate the native merchants engaged in the same trade? Would he not rather use his position to promote his own trade? There are merchants and merchants. Most of them are honest, but many are not. It was the experience of years ago that Consulships were sought by bankrupts who wished to begin anew in foreign lands, and who frequently succeeded, to the great damage of American mercantile reputation."

"Perhaps the advocates of the measure think that there are but few Americans engaged in trade abroad."

"That is probably true," the merchant replied, "but they are wrong. There are many American merchants in foreign ports. Will any one of them who becomes a Consul rise superior to his love of gain, or will he make it warm for competitors? Suppose that your merchant Consul is interested in some line of imports, and has a good stock himself, while the stock in the market is limited as compared with the demand. Just then a house that competes with that which he represents writes to him as Consul for information about that particular line of goods, with a view of making a shipment to that port. Would he consent to their glutting the market? Would he not, even if truthful, touch lightly on the possible profits and detail at length the difficulties to be encountered, and thus suppress a venture which might prove profitable? But that is not all. A Consul has no time for mercantile transactions, and a merchant has no time for Consular duties. If the Consul faithfully performs his duties according to the spirit of his instructions, he will have no time for trade. Indeed, trade would interfere with his duties in another way than in taking up his time, for the jealousies of competing merchants would throw every possible obstacle in the way of his investigations of the markets of the country, when, if he were Consul simply, they would be glad to seek his favor. The proposed bill," the merchant added, "is simply a measure for the suppression of American commerce."

The Engineers' Club of St. Louis has 106 members, of which 49 were added during the last year.

The programme for the ensuing year as given in the *Age of Steel*, is as follows:

December 1—"Earlier Floods on the Mississippi," J. A. Ockerson; January 17th—"Economy in Gas Engines," J. Sobolewski, and "Protection against Fire and Means of Extinguishing the Same," C. T. Aurbin; January 21st—"Use of Compressed Air," C. Shaler Smith; "An Improved Crane," Frederick Shickle. February 4th—"Elimination of Errors in Field Work," William Bonton; "Mill Creek Sewer," Wm. Wise. February 18th—"Street Pavements," Thos. H. Mocklind; "Improvement in Switches," Herbert Taussig. March 4th—"Experiments in Hydraulics," Henry Flad; "Treatment of Wood for Street Pavements," T. D. Miller and T. J. Caldwell. March 18th—"Pile Driving and Related Work," C. V. Mercereau; "The Use of Diagrams of Crank Effort in Designing," W. H. Alderice. April 1st—"Integrators," M. L. Holman; "Wood and Iron," K. Tully. April 15th—"Steamboat Shafts," H. W. Baker; The Efficiency of a Pair of Holtz Machines, the One Acting as Generator the Other as Motor," F. E. Nipher. April 29th—"The Utilization of Fuel by the Generative System," William B. Potter; "Dynamometers," Charles F. White. May 13th—"The Theory of Car Starters," J. B. Johnson, and a paper by Frank H. Pond. May 27th—"The Theory of Ammonia Refrigerating Process," C. M. Woodward, and the report of the committee on "Smoke Consumption."

Master Car Builders' Annual Report.

The report of the eighteenth annual convention of the Master Car Builders' Association has just been issued by the secretary, Mr. M. N. Forney. The report is remarkably well got out, and is unusually interesting, containing as it does the corrected list of standards adopted from time to time by the association. There came to be some diversity of opinion among the various car builders as to what sizes were really standard, and owing to this misconception all the evils of diverse sizes were being perpetuated on certain roads. If those interested will now study out the articles on standards in this report, which are simplified by comprehensive engravings, their uncertainty respecting standards will be ended. There are several other articles well worthy of perusal, and nearly all the discussions are interesting. Mr. Forney's article on "The Relation of Railroad Wheels and Rails to Each Other," is an important contribution to a subject which has received too little attention, and is of consequence to the manager and the engineer as well as to the mechanical department of railroad service. A feature of the report well worthy of imitation is its index. It is thorough, and nothing within the volume seems to be missed, and every conceivable way is used to identify readily the subjects of the various pages.

As an illustration of the favorable manner in which the enactment of the legislation needed to carry into effect the recently-negociated reciprocity treaty with Mexico is likely to effect manufacturing interests in this country, it may be noted that an Indiana firm of wagon manufacturers is said to have 1,000 wagons stored on this side of the Rio Grande River, waiting to go across to actual and prospective purchasers, the moment the law goes into full effect. The number of workmen to whom a few shipments of this kind would give employment, with the corresponding benefit to the agricultural and other manufacturing industries involved in their employment, may be figured out to advantage by those persons who are not yet alive to the importance of enlarging the foreign outlets for American products.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, DECEMBER 27, 1884.

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End of Volume VII.

As this issue of the AMERICAN MACHINIST completes Vol. 7, (for the year 1884) we present our usual annual index. The index is upon the same plan heretofore pursued. References to articles give the date of the issue when they appeared as well as the page. The index is therefore useful to the reader whether he has the whole 52 numbers before him or only a small part of them. As every number can be supplied promptly either through newsdealers or direct from this office, readers will see the importance of preserving the index for future reference. The volume, as a whole, gives a record of mechanical progress during the year. It will be noticed that in our department of "Questions and Answers" more questions have been asked and answered than in any previous year. This is partly owing to an increasing number of readers and partly to the fact that readers have become convinced by experience that their questions receive due attention and are answered so as to give real information, without cost to inquirer. The department of "Letters from Practical Men" continues to be a valuable and interesting feature of the paper, and all the other departments have been kept up to the standard, as they will be in the future. We contemplate no radical innovations.

The close of the year 1884 finds the machinery business, as well as most other kinds of business considerably depressed, but we trust that 1885 will witness a substantial revival of trade.

We wish all our friends a merry Christmas and a happy New Year.

Losses Through Want of Discrimination.

The very excellent, practical, and thoughtful address by Dr. Arvine on lubricants, which we publish on another page, draws attention in a forcible way to a source of waste in the operation of machinery which we have reason to believe greatly increases the expense of running many factories. A manufacturer running an immense aggregate of machinery required the oil best adapted for the various kinds of bearings without regard to price, long experience having convinced him that the cost of lubricants was a small matter, compared with the expense incurred through injury to bearings where unsuitable oil was used. This is another instance of the apparently cheap article proving the dearest in the end, but it also shows the necessity for discrimination in deciding what is the best article for a particular purpose. Mechanical engineers have to use their reflective faculties so constantly in attending to the operations they supervise that they justly have the credit of blundering as seldom as any class of scientific workers, yet the mistake, so often made, of assuming that because a lubricant answers admirably for one purpose, it must be good for nearly all kinds of bearings is but one among many popular errors that very sensible men freqently fall into. In recent wanderings through a wide area of country we were struck with the want of discrimination in making power arrangements suit the surroundings. Out in the far West in regions where coal is enormously expensive we have seen the most wasteful forms of engines driving machinery—engines that every six months wasted enough coal to buy a new engine that would have done the work for half the outlay. In most cases the boilers were worthy of the engines, and good substitutes would have quickly paid in savings the expense of making the change. As a rule bad boilers are more common than bad engines, and both kinds are far too numerous. Some steam users think that any kind of old boiler will suit them if it is capable of supplying the steam they need. So long as it is cheap enough in the first instance they do not care how much forcing may be needed to make steam, and if the boiler be of twice the capacity required it is a matter of indifference. To weigh against inferior engines and unsuitable boilers in places where coal is very expensive, is the familiar practice of putting fine large engines with wide margin of power in positions where coal is very cheap, and helping out their heat-saving capabilities by the use of the finest boilers and feed-water heaters. While it is generally economical to use engines that can be worked with a high rate of expansion, cases occur where saving is effected by using a smaller engine that permits the steam to escape at a higher tension. But probably the most prolific waste effected in the interests of economy is where water power is injudiciously adopted. A representative case of this kind was that of a large paper mill which was located on a river with a good supply of water. The site of the mill was down in a half-reclaimed swamp where the hauling of material was a difficult and expensive proceeding in wet seasons. When the river was in flood, which generally happened at the busiest time, the mill had to stop; occasionally they had to stop through the water being low, and ice in winter frequently caused protracted delays. The company struggled on for years, just keeping clear of bankruptcy, when a flood came along and carried away their dam. They could not repair the damage done by the flood, but, having a good business, some capitalists agreed to reorganize the company and move the mill to a better location, where there was cheap coal and good transportation facilities. The change was made and the corporation is now prosperous.

John Fink on the Road.

It appears that John Fink, the dispenser of "shop rights," to use his patent humbug oil-saving mixture of water, chalk, potash, oil and lime is still traveling around the country and industriously looking for customers. We published letters from many prominent establishments in our issues of March 22d, April 12th, May 10th and July 12th this year, showing how Fink had deceived them into paying for rights to use his humbug lubricator. The following letter from Col. Levi K. Fuller, Brattleboro, Vt., (dated Dec. 9th) gives evidence that Fink is not meeting with that booming success that attended his oily efforts before we gave him a free advertisement. In his own case, at least, Fink doubtless believes from experience that advertising does not pay.

Editor American Machinist:

Mr. John Fink, the "oil man," that you have "recommended" to the public, called on us this morning with a delicate Russia leather case, three big Russia bound books, and introduced himself as Mr. Fink, the oil man, who saved fifty per cent. on all oil. His stay was very short, as we announced to him that we did not care to indulge in any humbug; when he at once enquired how we knew he was a humbug, and we referred him to the AMERICAN MACHINIST for further particulars. He replied: "The AMERICAN MACHINIST be d—d," and took his hat and walked out in high dudgeon.

As he left we made the remark that if the operation of the law was placed in our control, he would change his opinion as to whether he cared for the AMERICAN MACHINIST or not.

You ought to manage to get his photograph and have his picture placed in the paper, for he is a handsome looking young man.

Very truly yours,
LEVI K. FULLER,
Vice-Pres. Estey Organ Co.

So far this year industrial exhibitions have not been particularly successful either in attracting exhibitors or visitors. Probably "hard times" has had something to do with this, but so far as manufacturers of machinery, and those who visit fairs to see it, go, such exhibitions have undoubtedly lost in estimation. As at present conducted, there is too much of the bazaar feature about them—the gigantic salesroom appearance—to make them of much interest to manufacturers of solid goods, who reason that the class of visitors attracted are not likely to be interested in their products. People are evidently becoming tired of visiting such expositions to buy cologne water and roller skates at advanced prices, and to see displays of goods neither better nor worse than they can see in a hundred stores and salesrooms. A little less prominence given to the fancy showroom business, and a little more attention to those things that represent substantial progress in the arts and sciences, would secure the attention of many who have lost their interest in industrial exhibitions, so-called.

The celebrated preacher, Robert Collyer, dropped into our office the other day to renew subscription to the AMERICAN MACHINIST for his younger brother, now a machinist residing in France. As the Rev. Robert himself began the study and practice of his profession, while earning his bread as a working blacksmith (and feels proud of it), it is evident that a taste for mechanical pursuits runs in the family. On Mr. Collyer's remarking that his brother had expressed himself to the effect, that there was "no paper published equal to the AMERICAN MACHINIST," we modestly accepted the compliment, but Mr. Collyer somewhat spoiled its effect by jovially remarking: "When people tell me there is no preaching like mine I don't believe 'em!"

The table we published last week giving particulars of the daily consumption of coal on the leading fast ocean steamers shows that high speed is obtained at enormous expense. Yet there has been remarkable progress made of late years in reducing the coal consumption per horse power of steam engines. The Sirius made the first Trans-Atlantic voyage with steam power in 1838, but the record of coal used was not kept with any regularity till the Cunard steamers were introduced in 1840. The average duration of the Britannia, an early Cunarder, was 14 days and 8 hours, and the daily consumption of coal was 38 tons, being 4.7 pounds per indicated horse-power. The Umbria is said to do her work on a coal consumption of about 2.4 pounds per indicated horse-power.

Mr. B. W. Payne, of Corning, N. Y., well known as a builder of portable and stationary engines, died recently at his home in that place. He was formerly a member of the firm of Bennett & Payne, dry goods merchants, of Brooklyn. From there he moved to Corning, and established a foundry and machine shop for the manufacture of engines. The business was so successful that about two years ago it became necessary to make a considerable extension. The City of Elmira offering advantageous inducements, extensive works were erected there and the business removed. Mr. Payne, however, still retained his residence in Corning. He leaves three sons, who were associated with him in the business.

Literary Notes.

That standard journal, the *Sanitary Engineer*, 140 William Street, New York, which has been publishing a series of illustrated descriptions of the interiors of modern built houses, has commenced to publish a series of large engravings showing exterior views of buildings that are particularly attractive. The December 4th issue, which begins a new volume, has a fine engraving of the residence of William K. Vanderbilt, of New York city. All who wish to study choice architectural designs should subscribe for the *Sanitary Engineer*. The engravings, it should be noted, are all made for that journal from drawings by the best artists. The December 4th issue contains the first part of an interesting article by J. C. Hoadley, on driven wells, illustrated by diagrams, and one of a series of articles on steam fitting and steam heating. Lively and well thought editorials give individuality and high character to the *Sanitary Engineer*.

Babyhood is the name of a new monthly magazine of attractive appearance just issued from the office of publication, 18 Spruce Street, New York. It is devoted exclusive-

ly to the care of infants and young children and the general interests of the nursery. Dr. Leroy M. Yale is medical editor, and Marion Harland, editor of the departments relating to general nursery routine. We quote from the salutatory announcement: "It believes that the baby's affairs are entitled to the best efforts of the best thinkers and writers whose services can be enlisted—professional and unprofessional, at home and abroad; it has secured the co-operation of specialists of the highest standing; and it intends to do its utmost to make itself a worthy occupant of the important field which it has chosen—a field wholly new in periodical literature." The first issue is highly creditable, and the magazine will doubtless achieve success. Subscription $1.50 a year, or 15 cents a number.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(496) J. A. L., Hahnville, La., asks: 1. What is the horse-power of an 18″x48″ engine, at 34 revolutions, the steam ports being 1¾x14″, travel of valve 4″, exhaust free, boiler pressure 75 pounds. *A.*—Such an engine, under the conditions named, should develop 75 to 80 horse-power. 2. In what number of the AMERICAN MACHINIST can I find a description of the Joy valve gear? *A.*—In the issue of Jan. 12, 1884.

(497) J. K. L., Whitinsville, Mass., writes: I am building a small double-cylinder upright engine 2½″x4″, to run 300 revolutions per minute, 100 lbs. steam pressure. The steam ports are ⅜″x1½″, exhaust port ¾″x1½″; bridges ⅜″. I would like to know: 1. What should be the length and depth of exhaust cavity in valve? *A.*—You can make the cavity 1 5-16″ long, and ½″ deep. 2. What should be the extreme length of valve? *A.*—2⅝″. 3. What travel should the valve have? *A.*—1¼″ 4. What power will the engine develop under the conditions named? *A.*—From 3 to 4 horse-power.

(498) A. P., Roxbury, Mass., writes: I have several hardened tools on which I wish to write my name. I have tried nitric acid, covering the surface with beeswax, but the result is not good. The lines are scratchy, and the metal outside is pitted. Can you tell me of a better way? *A.*—Use a mixture of about six parts nitric acid to one of muriatic acid. Warm the steel and cover carefully with the wax or the acid will penetrate at the edges of the letters and pit the steel as you say. To get clear letters you must cut the wax away smoothly, otherwise the edges will be ragged.

(499) G. D., Newburgh, N. Y., writes: 1. It requires a given power to move a body at a given velocity through water in a state of rest. What will be the relative resistance to motion, and power required, if the velocity is doubled? *A.*—Doubling the velocity makes the resistance four times as great, and as the body is moved through twice the distance in a given time, the horse-power exerted will be eight times as great. 2. What power is required to drive a single-acting pump 16″ diameter at a speed of 250 feet per minute, elevating water 90 feet, and what allowance should be made for friction? *A.*—We understand the travel, when forcing water, to be 125 feet per minute. The area of a 16″ plunger is 201″, and the pressure due to a head of 90 feet is 39 lbs. per square inch. Hence

$$\frac{201\times39\times125}{33000}=29.7 \text{ H. P.}$$

required to elevate the water. The friction will vary with the diameter and length of pipe, the bends in pipe, and with the mechanical construction of pump. It would not probably be less than 15 per cent. 3. What will be the relative resistance and power required if the speed of pump is doubled? *A.*—They will be doubled, or very nearly so. 4. Haswell says: "If a body move through a fluid at rest, the resistance is as the square of the velocity and the density of the fluid, $R=d\,v^2$. Also for elevating water

$$\text{H. P.}=\frac{w\,v}{33000}$$

in which w=weight of column, and v=velocity in feet per minute. In view of the fact that in both cases the water is started from a state of rest and discharged at the same (assumed) velocity, why, as a multiplier, should v be taken in one case, and v^2 in the other. *A*—In the instance of the pump it is a question of lifting so many pounds of water so many feet per minute—foot-pounds of work done. Doubling the velocity doubles the quantity of water in a given time, but the distance it is lifted remains the same. In the case of the body moved through the water doubling the velocity doubles the quantity of water moved in a given time, and also doubles the distance through which it is moved.

BUSINESS SPECIALS.

Transient Advertisements, 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Curtis pressure regulator and st'm trap. Dec. 13, p.10.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Figs. per set $1.00. S. M. York, Cleveland, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

Power Measured—F. Van Winkle, mechanical engineer, 22 Cortlandt street, New York.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Mech'l drawing and machine designing, work requiring skill and experience solicited Reasonable rates. Correspondence invited Weston & Smith, Syracuse, N.Y.

Split Pulleys at low prices, and of same strength and Appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Improved Tack Machinery, made by The Willets Manf'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Locomotive Engine Running. By Angus Sinclair. Price, $2. A handsome, interesting book. Just the thing for a holiday gift. Published by John Wiley & Sons, 15 Astor Place, N. Y.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

The Hendey Machine Company, Torrington, Conn. reports an increasing business.

Nathan Poor, it is stated, will erect a new morocco factory in Tapleyville, Danvers, Mass.

O. W. Bush, Chauncey, Ga., has commenced the erection of a factory for making lubricating oil.

The cotton factory project at Roanoke, Va, has been revived and will probably be carried out.

The sewing machine works of the Williams Mfg. Co., Plattsburgh, N.Y., will soon start up, full force.

The Texas Domestic Machine Company has been incorporated at Houston, with a capital of $50,000.

Jas. Batie and Fred. Schoenfield have started to erect an iron foundry, 40x100 feet, at Greensburg, Pa.

Saffold Berney, Anniston, Ala., is working up a company to establish a furniture factory in that city.

G. M. Snodgrass, of Lampasas, Texas, contemplates building a street car railroad in Brenham, Texas.

The Texas Constructing and Manufacturing Company, of Sherman, capital $50,000, has filed a charter.

It is reported that J. E. Van Doran, of New York, will invest $500,000 in iron works at Birmingham, Alabama.

A cotton seed oil mill with a capacity of 25 tons of speed per day has just been completed at Fort Worth, Tex.

The Birmingham Agricultural Works, of Birmingham, Ala., have secured a building for their factory and put in part of machinery.

The property owners of Verona, Pa., have donated one and one-half acres of ground to a company that proposes erecting a novelty works on the site.

Scanlan & Co., Louisville, Ky., an incorporated company, manufacturers of mantels, stoves, etc., have increased their capital from $40,000 to $150,000

Edwards & Sutherland are building a new flax-spinning mill at Paterson, N. J. Mr. Sutherland was formerly Superintendent of Barbour's flax mill.

In an item last week we made a mistake in saying that Mr. Hardie, of the new firm of Hardie & Collins, was a member of the firm of John Robertson, of Brooklyn.

The Foos Manufacturing Company, Springfield, O., is behind orders. It is now building an extensive addition to its factory and is running its works until nine o'clock at night.

The Northwestern Car Manufacturing Company, Stillwater, Minn., has been reorganized under the name of the Northwestern Thresher Manufacturing Company, with a capital of $7,000,000.

A car-load of machinery, including one of the Pratt & Whitney improved Gardner guns, has been shipped to the New Orleans Exposition by the Pratt & Whitney Company, Hartford, Conn.

William A. Harris, builder of the Harris-Corliss engine, Providence, R. I., is placing one of his 100-horse power engines in his works to furnish the increased demand for power to fill his orders.

All the cotton factories except one in Columbus, Ga., are running on full time, and have advanced the price of goods. The plaid mills are all full of orders and business prospects are brightening.

The Portland and Ogdensburg Railroad will build a new car shop at Thompson's Point, near the Basin. The building will be 50x200 feet in size, and will probably be completed by the 1st of January.

C. L. Sheldon, of Auburn, N. Y., will probably remove his axle factory—one of the largest in the United States — to Youngstown. Employment would, in that event, be given to 400 or 500 men.

A co-operative company have bought four acres of land in Wampum, Pa., and will proceed to build a wire mill at that place. The stock is $50,000. The mill will employ fifty skilled hands and a large number of laborers.

The American Brake Co. have closed a contract with the Chicago & Eastern Illinois Railway for equipping all the engines of that road with steam driver and tender brakes, deliveries to extend over a considerable period.

The Cowdrey Four-Cylinder Engine Co., Chicago, Ill., has been incorporated to manufacture and deal in steam engines and machinery, with a capital of $100.000; incorporators, Robert Cowdrey, Harry C. Berhoup, Alfred C. Clark.

The Binghamton (N. Y.) Oil Refining Company have issued a circular describing the peculiarities, properties and uses of their various lubricating oils. Engineers have long been acquainted with their popular "cylindroil."

The Kearney & Foot Company, Paterson, N. J., are selling files to England as a regular business. They can compete both in price and quality with British files. Their trade in England promises to increase and become permanent.

The A. S. Cameron Steam Pump Works, of New York, were awarded a diploma and medal at the Louisville Exposition. This pump has been accustomed to take medals at fairs every year, wherever exhibited, for the last quarter of a century.

The Martin's Ferry Pattern Company, with a maximum capital of $25,000 has been incorporated in West Virginia. The new Company propose to make patterns, moulds, fallows and flasks. The corporators are all workingmen of Martin's Ferry.

Akron possesses a magnificent water-power, but on all sides the automatic steam engine is put in and the water allowed to go its way. Cheap coal and high-class steam engines have placed water-power in the second rank.—*Miller & Manufacturer* Cincinnati.

A quiet movement is on foot in New Bedford, Mass., to induce firms and corporations employing many men to demand that every workman shall abstain from alcoholic drinks. If any of the men are found to use liquors they are to be discharged immediately.

Samuel T. Williams, of Baltimore, Md, builds an engine with balanced slide valve The steam passes through the valve, and the exhaust outside of it. He has a novel form of a piston ring, the use of which often saves re-boring and keeps the piston steam-tight.

Robert S. Brodhead and Evan R. Jones have purchased an interest in the Du Bois Manufacturing Co., of Tuskaloosa, Ala., and will add a foundry and general machine shop for building engines, boilers, etc. Expect also to manufacture stoves and other hollow ware.—*Baltimore Manufacturers' Record.*

A movement is on foot among a large number of nailers to build a nail factory on the co-operative plan. The scheme is already assuming definite shape. They propose to subscribe $46,000, which will be sufficient to put 50 nail machines in operation. The company will be backed by ample capital.—*Chattanooga Tradesman.*

The Phenix Mfg. Co., Paterson, N. J., are to make a large exhibit at the New Orleans Exhibition, of silk ribbons, dress goods and handkerchiefs made at their mills, by machinery designed and constructed by them. Dougherty & Wadsworth, of Paterson, will manufacture and sell ribbons and handkerchiefs at the Exhibition.

The A. S. Nellis Company, Pittsburgh, Pa., have just erected an addition 40x80 feet, for the manufacture of iron and steel wheels for agricultural purposes. They will also add to the machinery department, 4 drilling and tapping machines, 2 double headed screw cutting machines, 1 6 inch special tapper, 1 double punch and shears, 2 bending machines, 5 grinding machines and 3 heating furnaces.

Pedrick & Ayer, proprietors L. B. Flanders Machine Works, Philadelphia, have sent out two new calendars for 1885, of different styles. One of the engravings (made after their own design), shows a grouping of their special tools for railway repair shops. In the midst of them sits Science, in the person of an attractive young lady.

The Lucy Furnace Company, Limited, of Pittsburgh, is having one of the finest blowing engines in the country made by E. P. Allis, of Milwaukee, Wis. Its weight will be 150 tons. Its flywheel is to be twenty-five feet in diameter, will weigh 60,000 pounds, and will run at the rate of 55 revolutions per minute. The engine will be completed about the 1st of January next.

J. M. Allen, president of the Hartford Boiler Insurance and Inspection Company, Hartford, Conn. writes us to the effect that he has just returned from San Francisco, where he has established a branch office for that company. F. B. Allen, General Supervising Inspector of the Company, is now in California, and will remain a few weeks, or long enough to get the new office well started.

John J. Grant (formerly of Grant & Bogert) has started a machine shop, to build machine tools, under the name of Grant Machine Tool Works, at Flushing, N.Y. The shop is 100x45 feet, and several machines are now running. Several orders for milling machines and automatic rack cutters have been taken, and the force of 15 hands will probably be kept busy night and day.

The Babcock & Wilcox Co, New York, are replacing old-style boilers, as follows:

Ansonia Clock Co., Brooklyn, N. Y.....214 H. P.
Empire Ref'g Co., Hunter's Point, N.Y....184 H. P.
Pitts Agricultural Co,, Buffalo, N. Y.....100 H. P.
New York Herald Building, N. Y. City.. . 244 H. P.
Ingenio Emilia, Cuba .....240 H. P.
Nottingham Mills, Providence, R. I.....208 H. P.

A fire in the early part of the week destroyed the main building of the repair shops of the St. Louis, Alton & Terre Haute railroad in East St. Louis, involving a loss of something like $15,000. The building was a one story frame structure, 250 feet long by 100 wide, and was used for repairing and painting locomotives and cars. Two locomotives, two coaches and two box cars were also consumed by the fire.—*Age of Steel.*

The Standard Vapor Fuel Iron and Steel Company, owners of an extensive factory at Elizabethport, N J., will remove their works to Flushing, N. Y. The company has purchased 147 lots in close proximity to the railroad track, and excavations are being made for a building 60x160 feet in size. Upon the completion of this main structure several additional buildings will be erected. The factory people have been guaranteed liberal concessions by the Long Island Railroad Company, which is the principal cause for removal. It is said that the industry will furnish employment to over 100 people. —*Brooklyn Real Estate Review.*

The Livesey Manufacturing Company, New London, Conn., is now well established in its new shops, where it has some fine new tools and all the apparatus for repairing steamboats, fishing boats, making and repairing boilers, and will continue the manufacture of roller bushing. The new shop and foundry are built of brick. The boiler shop is almost completed, and will be occupied about the middle of December. A large shear is being located on the wharf, capable of lifting fifty tons. Its headquarters are next door almost to the Norwich Line of steamers' wharf, and only a few steps from the London & Northern Railroad depot.—*Manufacturers' Gazette.*

The Columbus (Ga.) Iron Works Co. have placed one of H D. Stratton's improved ammonia absorption ice machines on exhibition at the World's Fair in New Orleans. They will manufacture ice during the exposition, with the privilege of selling the ice on the grounds. Capacity five tons per day. During the past season two of these machines, capacity ten tons each per day, have been erected in Fort Worth, Texas; one five-ton in El Paso, Texas, and two ten-ton and one five-ton in Columbus. Orders are now in for one ton and one five-ton machines. They will also exhibit one of Raoul's patented car wheel journal boxes, of which they own the right. Mr. Raoul, the patentee, a practical mechanic and inventor, is President of the Georgia Central Railroad. These journal boxes are used on several prominent railroads of the South, and 8,000 of them have been used by the Pullman Car Co. for the Cincinnati Southern Railroad.

The *Paterson* (N. J.) *Press* says: Among the exhibitors from this city at the New Orleans Exposition will be Mr. Benjamin Eastwood. His exhibit comprises a complete set of laundry machinery, there being thirteen to fifteen machines for washing and ironing. One of the ironing machines is the largest ever made, having a cylinder 40 inches in diameter, and 8 feet long. This machine will iron readily fifteen hundred pieces an hour, from a napkin to a sheet in size. Both washing and ironing are accomplished with the greatest rapidity and with a minimum of trouble. Mr. Eastwood is the sole manufacturer of these machines, which were invented by Mr. Hamilton E. Smith, and which are fast being adopted by the principal laundries, public institutions and hotels throughout the country. The manufacture of these machines has opened up a new industry for that city, which has been in operation about one year. Mr. Eastwood is continually adding facilities to his shop for making these machines. Up to Monday his force of men have been working full time. He has been kept busy also repairing and altering silk machinery to manufacture the many novelties that are continually being introduced by the silk manufacturers.

The Senaca Falls (N. Y.) Mfg. Co. have issued a new illustrated catalogue of scroll saws and lathes. Some new patterns have been introduced.

Machinists' Supplies and Iron.

NEW YORK, December 11, 1884.

The supply trade continues quiet, with no notable change for the better. The unsettled condition of wages appears to be militating against business. Experienced observers say that trade was never known to improve when wages were going downward, and, if this is true, there appears to be little hopes of improvement very soon.

Iron—While lower grades of pig iron appeared to find no resting place in their downward course standard Lehigh brands remained for a long time firm at about $19, but they have now followed their weaker rivals by dropping down. The apprehension that Southern pig iron was going to seriously affect Pennsylvania products has subsided, but it is now generally understood that Southern pig has obtained a hold on the market in a small way, and will continue to increase in volume. For all grades of pig the demand is light. We quote standard brands No. 1 X. Foundry $18, but good brands can be bought for less; No. 2 X. $17; Grey Forge, $15 to $16.

Scotch Pig—This market has been dull, and sales restricted to very small proportions. Values are only nominal. Shotts, $21.50 to $21.75, to arrive; Coltness, $22, to arrive; Glengarnock, $20.50, to arrive, $21.50 yard; Gartsherrie, $21.50 to $22; Summerlee, $21; Cambroe, $20.50; Langloan, $21; Dalmellington, $19.50.

Copper Ingot has declined in value since last week, but the volume of business done has been limited. Lake has been sold for 12 cents, and even less. Baltimore is reported to have sold as low as 10⅛ cents, and other brands are nominally quoted at 11 to 11⅛ cents.

Lead—The market for common pig has experienced a sharp advance. Sales of larger quantities have been made during the week at 3.70 cents, and the price remains firm at these figures, but most of buyers are holding off

Tin has been tending slightly downward, with little business transpiring. For jobbing lots we quote Banca, 19 cents; Straits and Malacca, 16¼ to 16⅜ cents.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Working foreman for a small foundry making machinery castings. Address "Foundry," Box 98, Indianapolis, Ind.

Wanted—Position as foundry foreman by a competent man who has held similar place over twelve years. Address X. L., AM. MACHINIST.

An experienced brass turner and Fox lathe hand wishes employment. Address Robart Dobbins, Long Island City, N. Y.

Wanted—Position as foundry foreman. Practical, reliable, and temperate. 18 years' experience. Address J. D., Care AM. MACHINIST.

Wanted—An experienced salesman to sell Automatic steam engines and other machinery. Address Box 9, AM. MACHINIST.

A mechanical draftsman of good technical education and four years' practical experience, desires situation. References. Address Draftsman, P. O. D. 38, New Haven, Conn.

Wanted—A first-class man to straighten shafting. None but man of thorough experience and ability need apply. Work by day or contract. Address M. M., AM. MACHINIST.

Situation wanted as draughtsman or at office work by one having ten years' experience as machinist, draughtsman, and bookkeeper. R. P. Brown, Room 10, TRIBUNE Bldg., Chicago, Ills.

A mechanical draftsman of large experience as designer, with shop experience, wishes an engagement. Would prefer an establishment building steam engines of the Corliss type. Best of references. Address E. C. B., care AM. MACHINIST.

Two first-class mechanical draftsmen wanted on light machinery and tools. Those capable of making drawings from dictation. Only experienced men on this class of work need apply. Address, giving experience and references, Brown & Sharpe Mfg. Co., Providence, R. I.

Wanted—A second-hand engine lathe, 12 to 18 inch swing. Address L. S., West Morris, Ct.

For Sale—No. 2 Long & Allstatter double-power punching-press. Good as new. Address Dueber W. C. Mfg. Co., P. O. Box 1334, Cincinnati, Ohio.

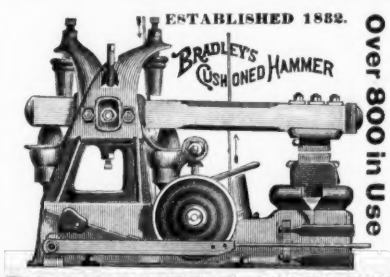
For Sale at a Bargain.—A very heavy second-hand Iron Planer, that planes 24 ft. long 62 in. x 62 ft. Good condition and good maker. The George Place Machinery Company, 121 Chambers street, N. Y.

For Sale—Our Worthington duplex steam pump, nearly new, in perfect order, size 4½ x 2¾ x 4. Will be sold low if applied for soon. Address Wm. H. Clapp, Weymouth, Mass.

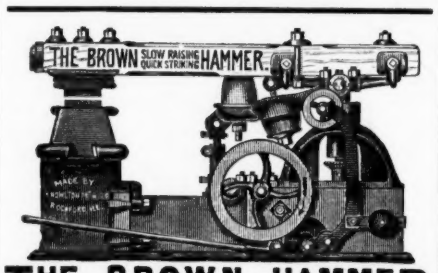
HILL, CLARKE & CO.
36 Oliver St., Boston, Mass.
BRANCH OFFICE & STOREHOUSE.
800 N. Second Street, St. Louis, Mo.

Machinery for Sale.

SPECIAL BARGAIN.
ONE GLEASON SCREW-CUTTING ENGINE LATHE,
40 inch swing, 12 feet bed, all complete, in fine condition.
Catalogues of NEW MACHINERY on Application.



BRADLEY'S CUSHIONED HAMMER.
Stands to-day without an Equal.
It approaches nearer the action of the Smith's Arm than any Hammer in the WORLD.
BRADLEY & CO., Syracuse, N. Y.



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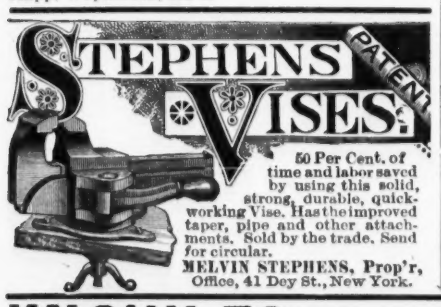
STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer.
A NEW MOVEMENT { SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., King St., Rockford, Ill.

FOR SALE VERY LOW
BEFORE TAKING STOCK.

1 Iron-Frame Circular Saw Table for 14" Saw.
1 4" one-side Moulder.
1 16"x6' Drill or Speed Lathe.
1 16"x8' Pattern Maker's "
1 16"x6' Drill Lathe with Milling Machine attached.
1 24" Stationary-head Upright Drill.

For full particulars call on or address
COOKE & CO.,
22 Cortlandt Street, N. Y.

JUST PUBLISHED.
Dynamo Electric Machinery:
A Manual for Students of Electrotechnics.
BY SILVANUS P. THOMPSON, B.A., D.Sc.
388 pages, 8vo, cloth, illustrated by 230 engravings.
Price, $5.00.
E. & F. N. SPON, 35 MURRAY STREET, N. Y.

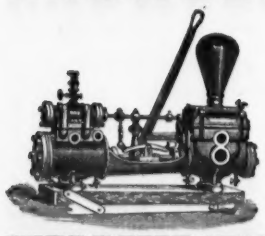


50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.
MELVIN STEPHENS, Prop'r, Office, 41 Dey St., New York.

FRICTION CLUTCH PULLEYS,
Hoisting Engines and Hoisting Machinery,
D. FRISBIE & CO.,
481 North 5th St., Philadelphia, Pa.

BINDERS FOR THE AMERICAN MACHINIST, $1.00 BY MAIL. 96 FULTON STREET, N. Y.

KNOWLES PATENT STEAM PUMPS.
THE STANDARD!



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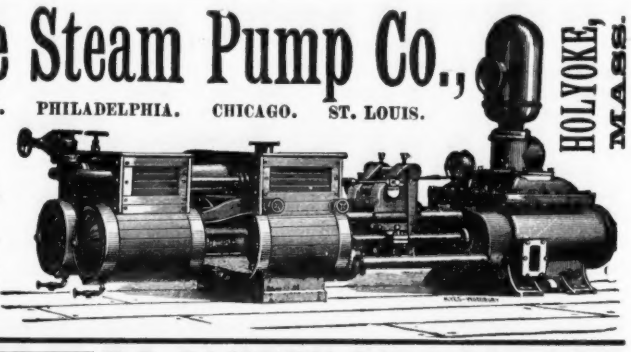
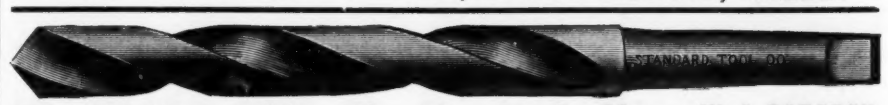
Estimates furnished on application for Pumping Machinery of any capacity, and to work against any pressure.
Air Pumps and Condensers for steam Engines a specialty. Will save from 20 to 30 per cent. fuel.
SEND FOR ILLUSTRATED CATALOGUE.
—ADDRESS—
KNOWLES STEAM PUMP WORKS,
93 Liberty St., New York, and 44 Washington St., Boston, Mass.

The Deane Steam Pump Co., HOLYOKE, MASS.
NEW YORK. BOSTON. PHILADELPHIA. CHICAGO. ST. LOUIS.
MANUFACTURE
PUMPING MACHINERY
FOR ALL DUTIES.
Send for New Illustrated Catalogue.



FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.
JAS. HUNTER & SON, North Adams, Mass.



STANDARD TOOL CO., Cleveland, Ohio. { W. A. BABCOCK. Manager.

MILLING MACHINES. SEND FOR DESCRIPTIVE CIRCULARS AND PRICES.
C. E. LIPE, Syracuse, N. Y.

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$50
Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scrolls, Saw Attachments, Chucks, Mandrells, Twist Drills, Dogs, Calipers, etc. Send for Catalogue of outfits for amateurs or artisans. Address
H. L. SHEPARD, AGENT,
134 E. Second St., Cincinnati. O

FOUNDRY PRACTICE.
ADVERTISERS wish to produce a Reliable Book on all kinds of Foundry Practice, embodying the results of actual experience in different parts of the world, in Iron—Malleable, Cast, &c.—Steel, Brass, and other work. Persons qualified to contribute practical information—which will be paid for—should address E. F., Office of THE IRONMONGER, 42 Cannon street, London, E. C., England. The Editor-in-Chief will arrange the purely literary side of the matter, so that those having the requisite knowledge need not hesitate to apply on account of their lack of literary experience. Drawings should be furnished where they can be used advantageously.

Popular Oil Tanks.

The Best Finished Oil Tanks in the Market. The Cheapest FIRST-CLASS Oil Tank in the Market.

Portable Forges

STRONG, DURABLE, COMPACT, CHEAP.

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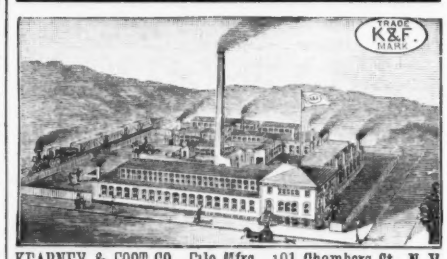

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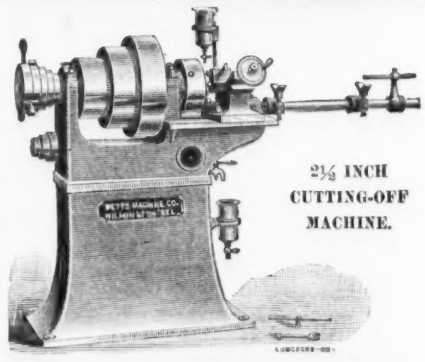

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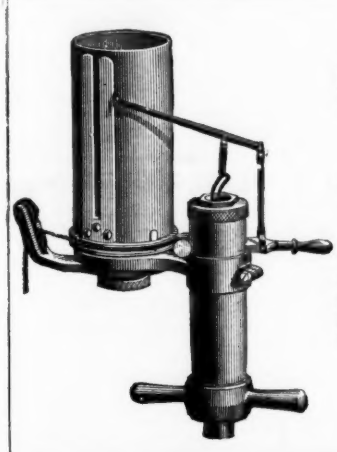

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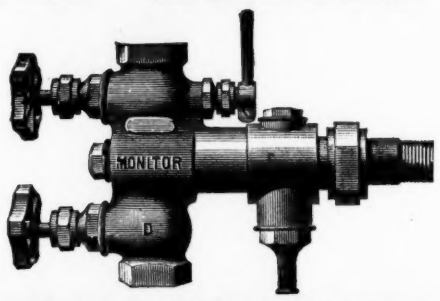

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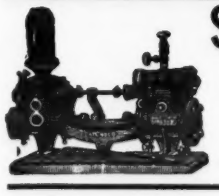

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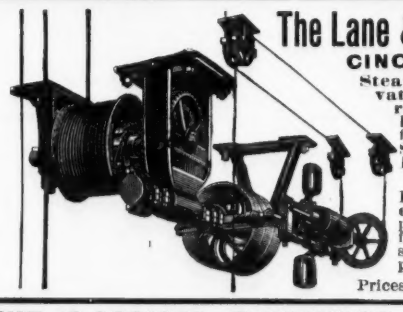

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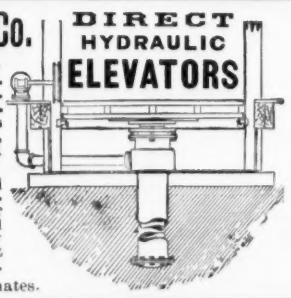

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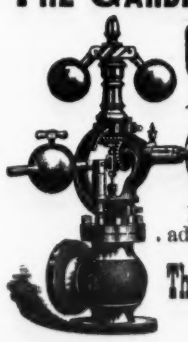

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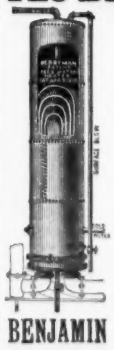

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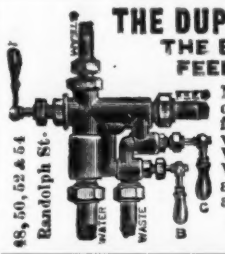

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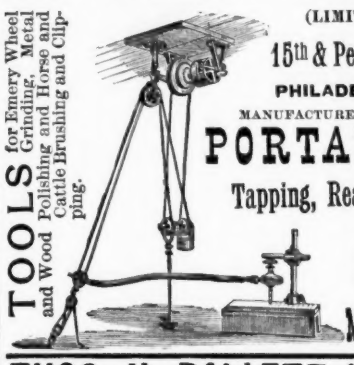

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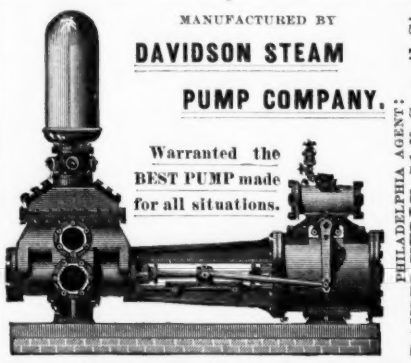

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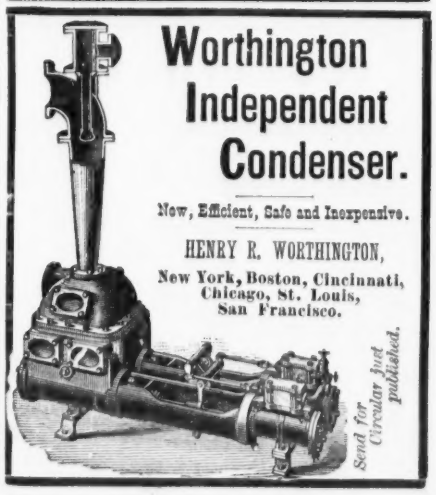

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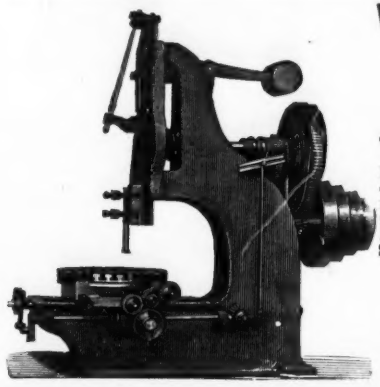

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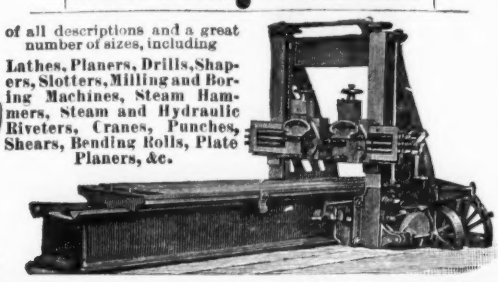

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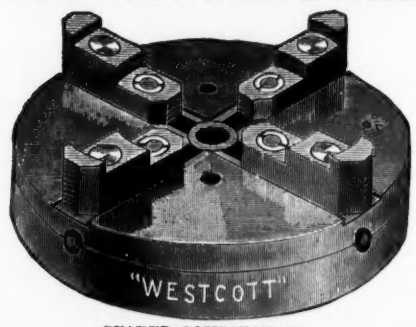

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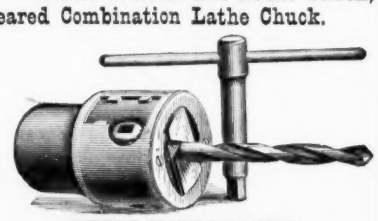

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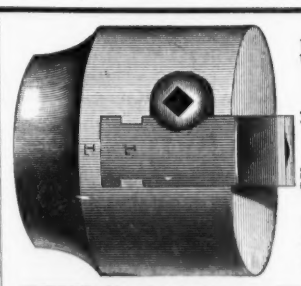

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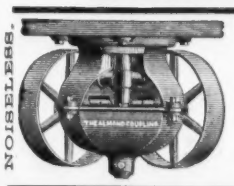

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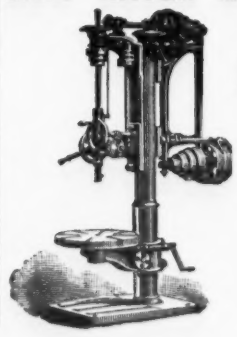

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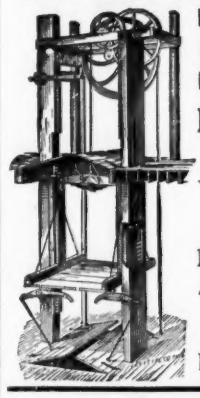

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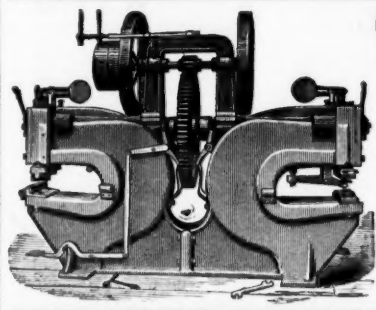

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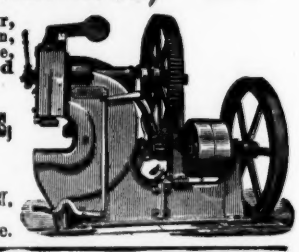

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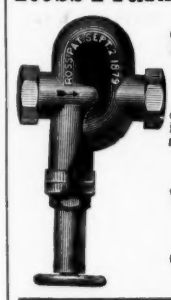

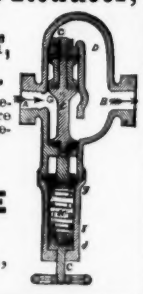

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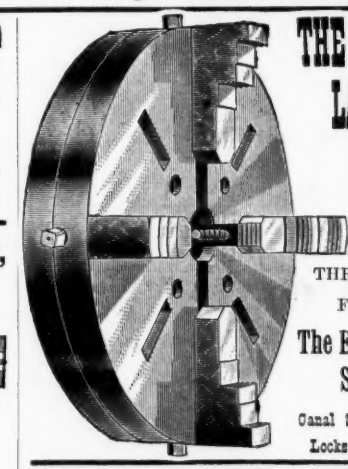

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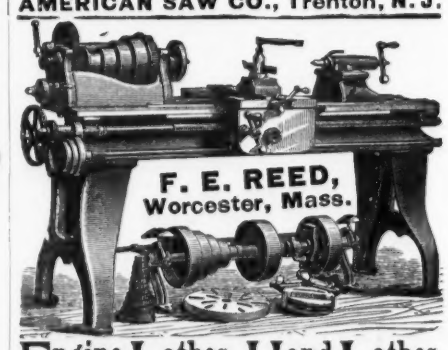

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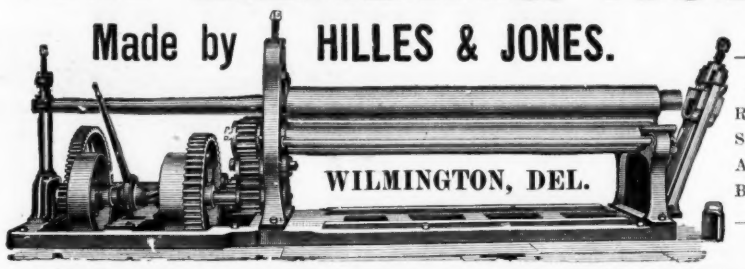

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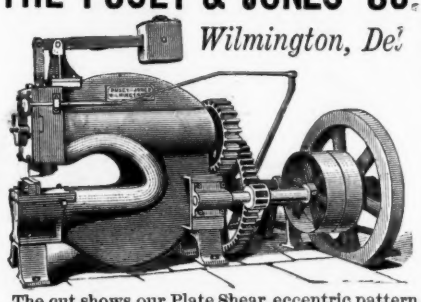

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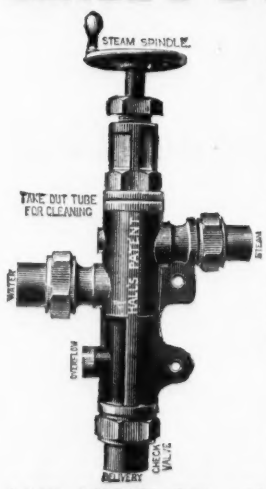

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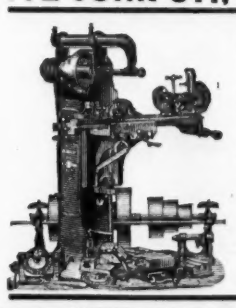

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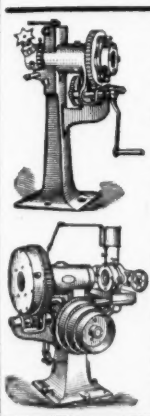

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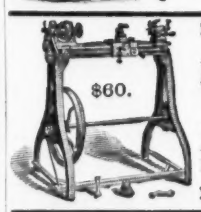

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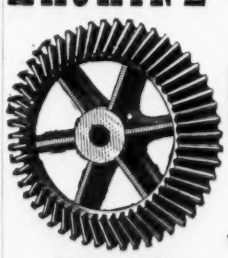

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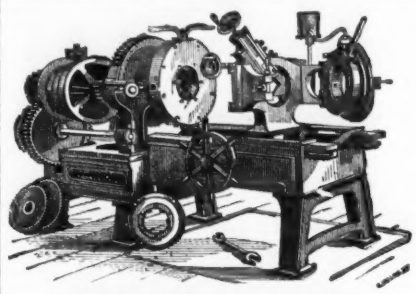

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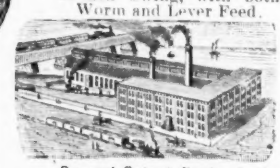

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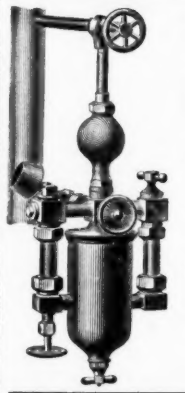

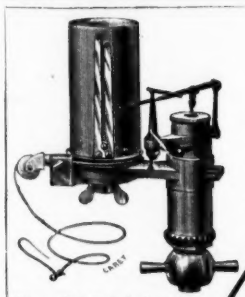

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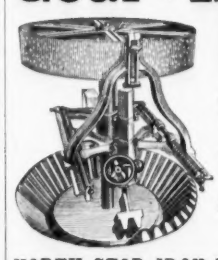

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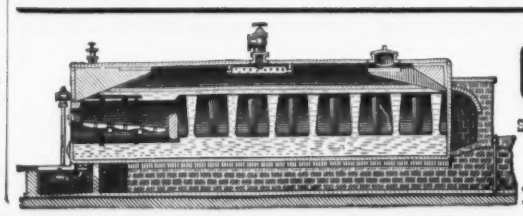

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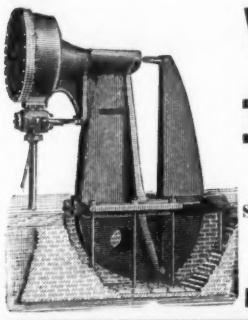

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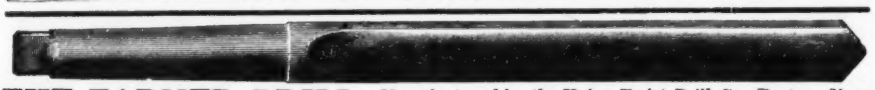

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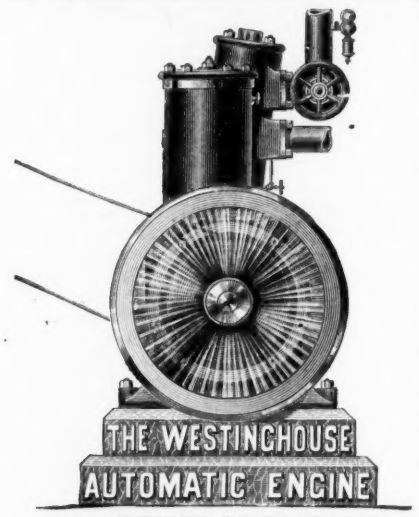

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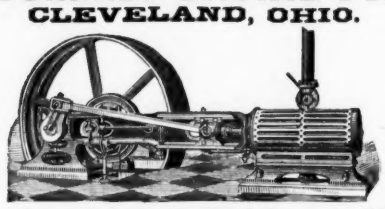

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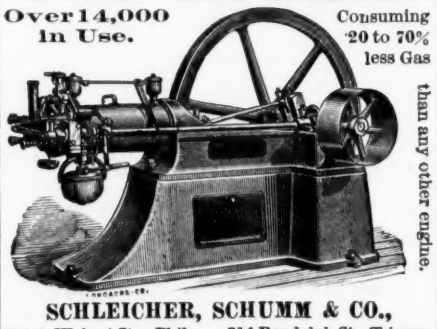

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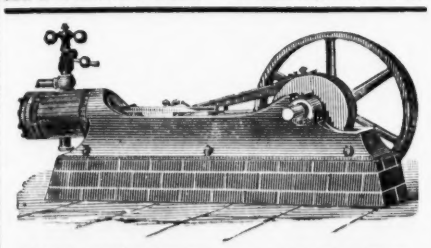

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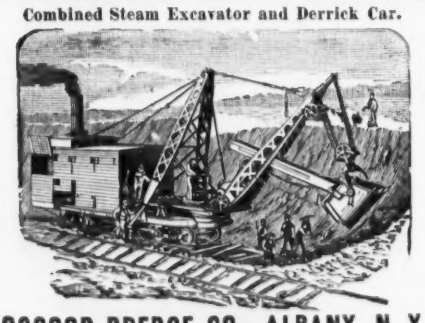

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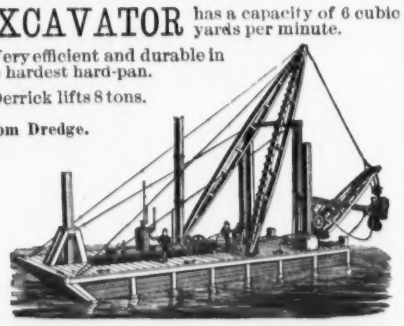

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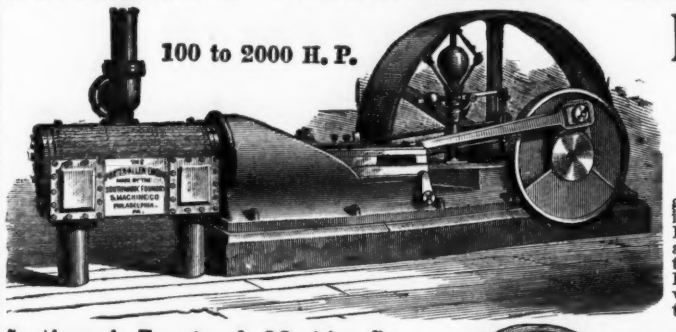

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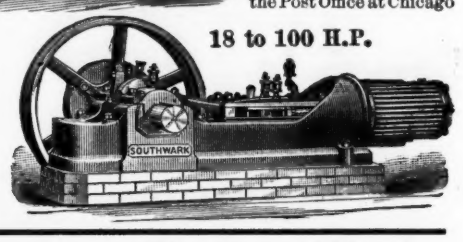

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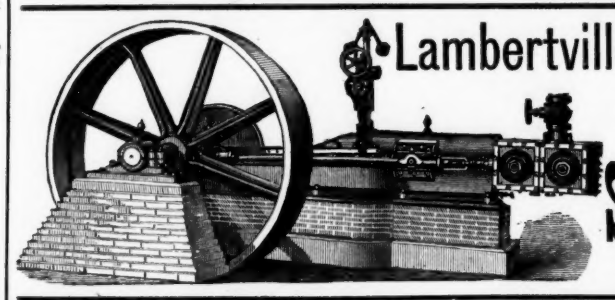

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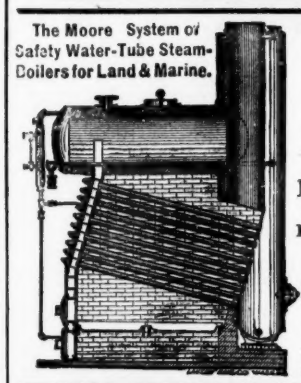

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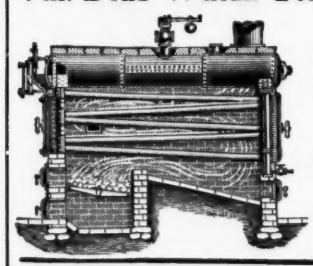

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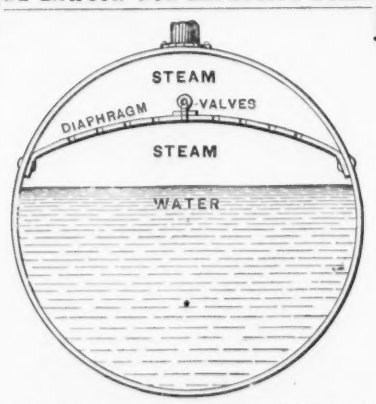

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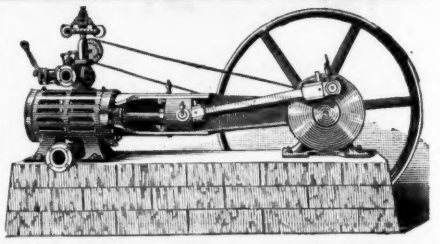

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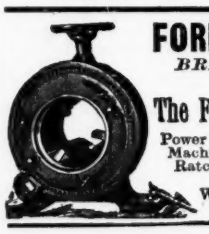

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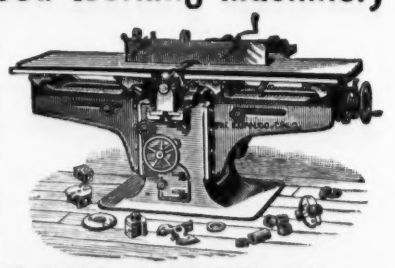

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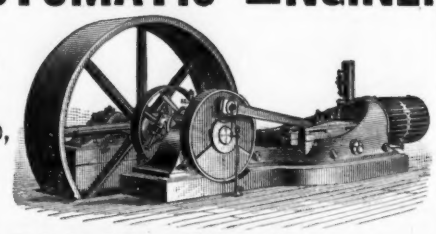

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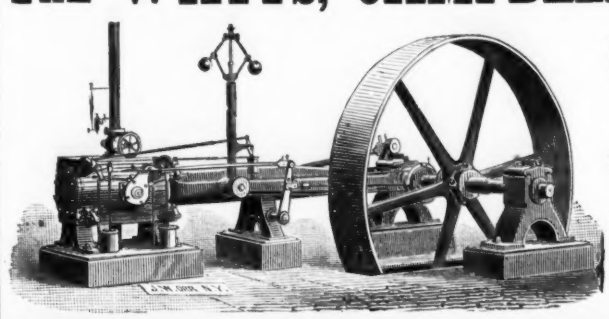

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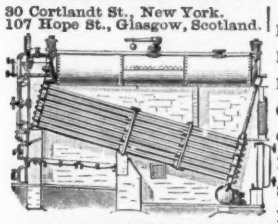

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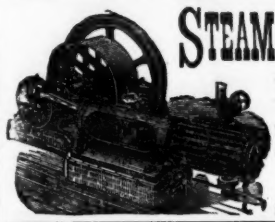

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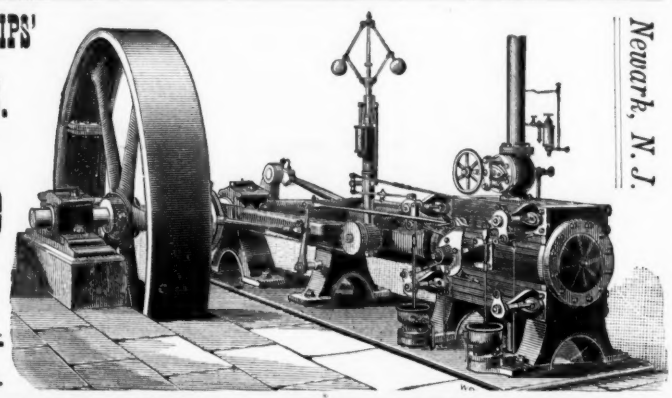

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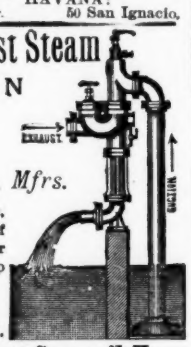

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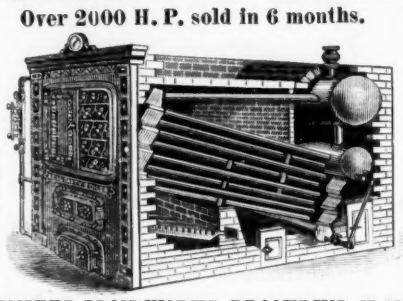

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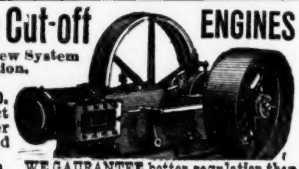

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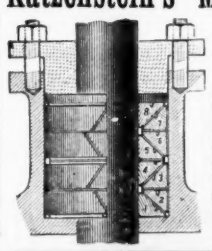

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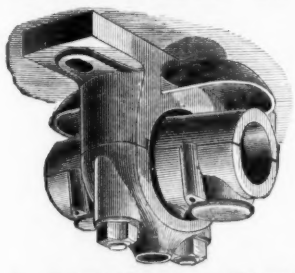

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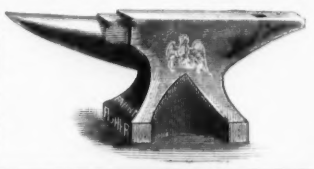

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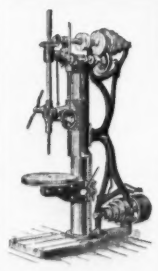

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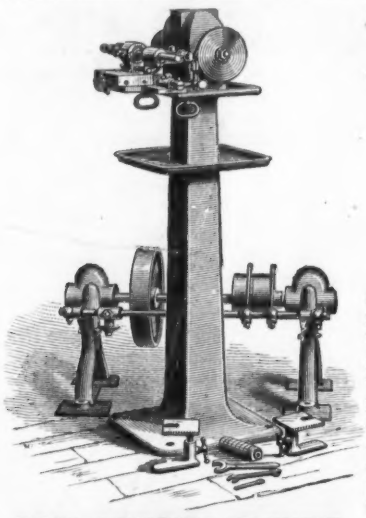

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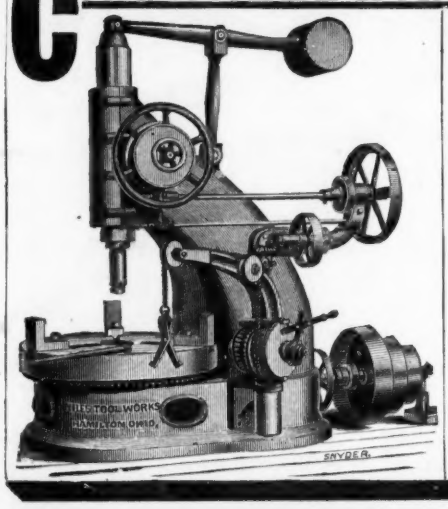

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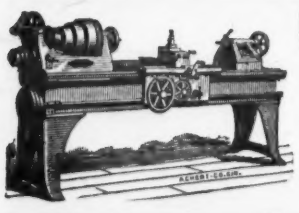

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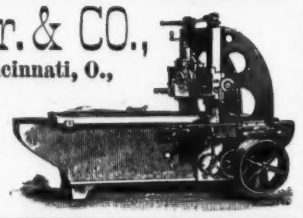

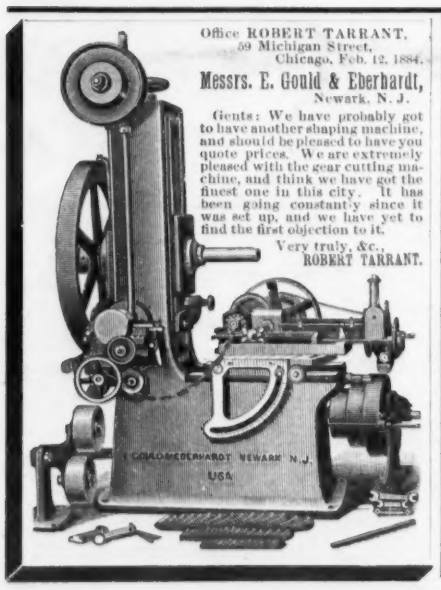

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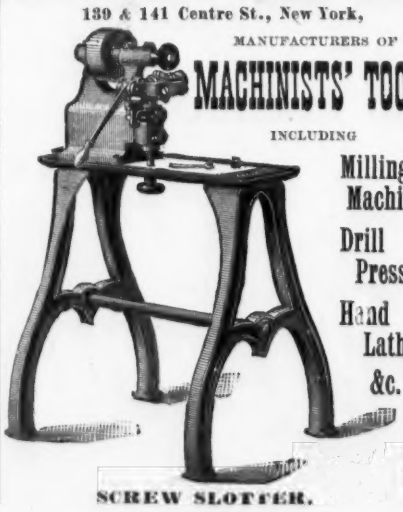

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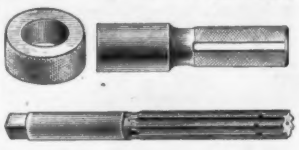

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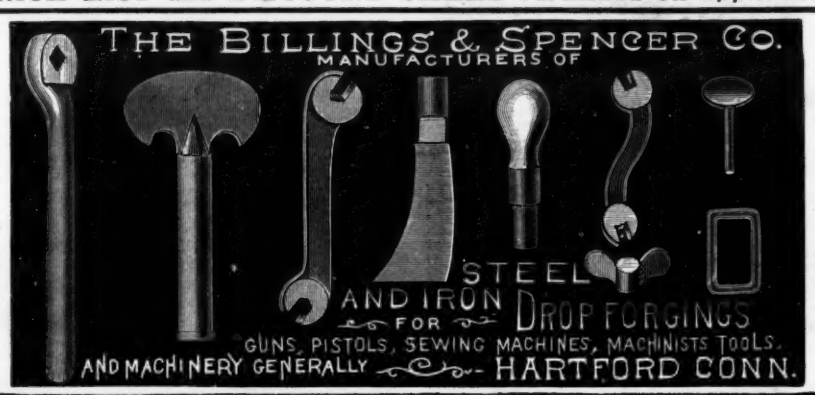

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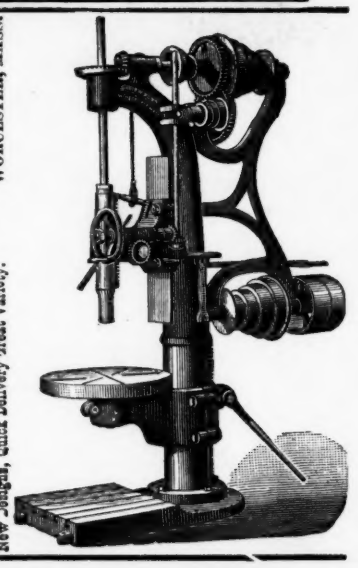

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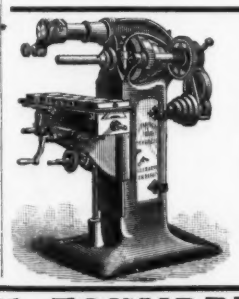

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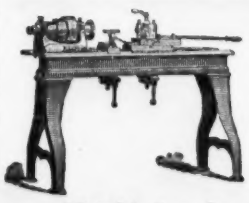

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